THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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LONDON'S ELECTRICITY SUPPLY.

WITH the publication of the draft order of the Electricity Commissioners constituting the London and Home Counties Electricity District and establishing the Joint Electricity Authority for that area, a new page is turned in the history of London's electricity supply. The scheme, which is outlined elsewhere in this issue, will come before the second inquiry, which will be held next month, and it will doubtless be the subject of searching criticism, for it adopts a mode of compromise of a rather unexpected nature.

Whilst a Joint Electricity Authority is to be formed for the whole of the area, the actual conduct of electricity supply within a large portion of the district, including the whole of the County of London, is to be entrusted to two committees appointed by the Authority, a "Committee of Local Authority Undertakers" and a "Committee of Company Undertakers," these committees comprising the members of the Authority who respectively represent the two classes of undertakers. To the Committees the Joint Authority will delegate certain of its powers and duties (specified in an annex to the Order) until the whole of the generating stations and main transmission lines belonging to the undertakers concerned which are to be transferred to the Authority have become the absolute property of the latter body.

Thus the electricity supply of the County of London is to be shared between the local authorities and the companies—an arrangement which tallies with the Bill to be introduced into Parliament by the London Electricity Joint Committee (1920), Ltd., of which particulars were given in our issue of February 2nd; but the Electricity Commissioners' scheme goes farther than the Bill, in that it includes not only the nine companies which are promoting the Bill, but also the five companies which are not promoters—two of them being very important. So far as the nine are concerned, we take it that some measure of agreement has been attained, though the fact that they are seeking statutory powers suggests that they are not wholly satisfied with the Commissioners' proposals; but as regards the five, it would seem that their assent has yet to be won—for it must be remembered that no undertaking can be compelled to take part in the scheme.

Turning to the municipal side of the question, it should be noted that the Local Authority Committee embraces not only about half the County of London (15 metropolitan boroughs), but also 19 Corporations and Urban District Councils outside the county bounds—ranging from Reigate to Leyton, and from Gravesend to Guildford. There are several other local authority undertakings which are not scheduled to come under the Committee, having presumably elected to stand out, though they are within the jurisdiction of the Joint Electricity Authority. The remainder of the large area covered by the Joint Electricity Authority is served partly by a number of small companies, but mainly by the Metropolitan Electric Supply Co., Ltd., and the North Metropolitan Electric Power Supply Co.; these two concerns, which rank as "Power Companies," are practically authorised by the Draft Order to carry on without interference from the Joint Authority, the latter merely becoming the channel through which their development proposals are to be submitted to the Commissioners.

Taken as a whole, it will be seen that "compromise" is the keynote of the scheme, and that in many respects the compromise is rather hoped for than accomplished. In the absence of compulsory powers, the Commissioners have no alternative but to seek an agreed solution to the tangled problem of London's electricity supply, and whatever may be thought of the details of their scheme, they must at least be complimented on the successful formulation of a feasible plan, which must have involved a vast amount of labour and negotiation—and which will certainly give rise to lively discussion, from which bitter opposition will not be wholly absent. Whilst the consummation of the desire that the supply of electricity to the whole district shall be concentrated in the hands of one authority is obviously still in the remote future, the scheme, if carried into effect, will constitute a long step towards that end; but the process of concentration and unification will be long and difficult.

Light for Industrial Purposes.

From time to time the question crops up whether electricity used for photographic or other industrial processes depending upon the action of light should be charged for at lighting or at power rates. Practice differs according to the mental attitude of the manager of the supply undertaking concerned; those who take broad views and are not fond of splitting hairs, charge the lower price, whilst those who are obsessed with the bureaucratic spirit of slavish adherence to the letter, maintain that lighting is lighting, whether it is used for illumination or not. With the latter class we have no patience. That is the spirit which so often calls forth the complaint that whereas the "gas people" will do anything to please a customer, the electricity people put obstacles in his way, and haggle over straws.

It should be borne in mind that lighting is charged for at a high price because consumers all want it at the same hour, thus producing a peak in the load and necessitating the installation of plant to meet the maximum demand. If lighting consumers took their supplies at all odd hours of the day, their diversity factor would be so great that the lighting peak would disappear, and there would be no excuse for laying upon their shoulders the bulk of the capital charges. The "peak," in fact, is the sole justification for charging them at a higher rate than power or heating consumers.

But light used for industrial purposes—as for photography, kinematography, colour-matching, &c.—need not, and in many cases it does not, come on the peak at all; in such circumstances there is no logical reason for charging for it three times as much as for power or heating. This view was taken by Mr. Justice Swift in a recent law-suit (Elec. Rev., May 26th, 1922, p. 730) in respect of a photographic arc lamp; he decided that the energy was used for power and not for lighting, and sarily the same rate as applied to the users of motors. This decision was confirmed by the Court of Appeal (Elec. Rev., November 10th, 1922, p. 683).

The matter is important in view of the rapidly extending use of "daylight" lamps on a large scale for colour-matching, where the light is used continuously for many hours a day, not for illumination (which could be efficiently done with a fraction of the power used by the "daylight" lamps) but for an industrial purpose. A still more convincing case is that of lamps used solely for the artificial fading of coloured fabrics, which are on circuit for 24 hours a day, and in equity ought to be supplied at the very lowest tariff—especially if they were cut off during the peak-load period, an arrangement which would present no difficulties. By using this method of testing the "fastness" of dyes, an immense saving of time is effected as compared with the use of sunlight, which varies very widely from day to day and from winter to summer, whereas the electric arc is constant in quality and available day and night continuously. Such uses of electricity should be fostered and encouraged by an equitable tariff—for they are more desirable to the power station engineer than any other class of load. To charge for them at lighting rates is as unjust as it is absurd.

An Engineer Sentenced.

Electrical men generally and municipal electrical engineers in particular will regard with feelings of profound disappointment and regret the fact that one of their number has so betrayed the trust that was placed in him by his employers as to bring himself under sentence of imprisonment. At the Assizes last Saturday Mr. W. T. Kerr was sentenced to three years' penal servitude on charges (already reported in our pages) of having misappropriated large sums of money which were the property of the Hereford Council, for which he had acted as borough electrical engineer for a long period. The whole matter is as mysterious as it is deplorable, and until the law had found him guilty it was pardonable for electrical men to hope that either some mistake had been made or there were mitigating circumstances. Now that the usual course has been run and sentence has been passed, the matter might by some be considered closed, but we do not think it right to allow the occasion to pass without asking whether there was not inexcusable laxity on the part of somebody else. Mr. Kerr was a trusted official, it is true, was responsible for the conduct and development of a specialised and important public department, and a long career of satisfactory work gave no room for fear that he would betray the trust reposed in him. But however trustworthy an official may be, there is surely somebody whose duty it is to check financial transactions such as those which have brought about the Hereford downfall. We shall hope to hear more of that side of the matter, not in any way in defence of W. T. Kerr, but in the interests of municipal undertakings.

It is not unlikely that there will be a disposition to regard municipal electrical engineers as being more than a little lower than the angels because one of their number has fallen, but it is with feelings of satisfaction that in glancing back over the whole period of municipal electrical working in England we are unable to recall another case of the kind. Often enough the "chiefs" have been in the peculiar position of privilege, with a public status exposing them to temptation and extravagance which their salaries alone could not easily carry, yet their main errors have been due to incompatibility of temper and other minor mistakes, for in our recollection there has been no other borough electrical engineer who has been found guilty of systematic embezzlement of public funds. Indeed, we claim for borough electrical engineers as a class that their standard of integrity and honour in the conduct of their departments is very high, and that most rare have been the occasions for reproach.

Accidents in Mines.

In a preliminary statement just issued by the Mines Department, we learn that during the year 1922 the number of separate fatal accidents amounted to 1,073, resulting in 1,153 deaths. Unfortunately the year was marked by three serious explosions of fire-damp or coal dust, causing 57 deaths in all. One of these occurred at Plean Colliery, Stirlingshire, resulting in a loss of 12 lives, and the other two in Cumberland, one at the Haig Pit, with a loss of 39 lives, and the other at St. Helen's Colliery, with a loss of six lives. We believe all these accidents were primarily due to shot-firing, and had the rules and regulations been strictly carried out, they might have been avoided. Apart from these accidents, the death-rate appears to be the same as for the year 1921, allowing for the three months' stoppage of all the coal mines during this year; the figures for the nine months' working being 799 separate fatal accidents, causing 813 deaths.

The majority of the underground accidents, however, are mainly due to "falls of ground" and "haulage"; there being no fewer than 546 caused by the former and

211 by the latter. On the surface of the mines 106 fatal accidents occurred; no doubt, as the inspectors frequently report, very many of these could have been avoided had reasonable care and attention been displayed, and evidently nothing but a vigorous "Safety First" campaign amongst the workmen will ever seriously reduce this type of accident.

We regret to notice that under "Electricity" there were seven fatal accidents below ground and two above ground, making a total of nine, which we believe is higher than it has been for some years; we had begun to think that accidents due to the use of electricity, in spite of its very large increase, were steadily on the decline.

The Report on the Exhibition.

There was no mincing of matters in the report of Sir W. Joynson Hicks's investigation of questions connected with the organisation of the British Empire Exhibition. Its recommendations have been received on the whole with favour, though misunderstanding of the attitude of the Executive led at one time to fears that the whole scheme might be wrecked. It is, as we have said already, most deplorable that the need for such an investigation should ever have arisen, but the revelations of the report fully justify the holding of the inquiry. Now that it is ended and the worst is known, there is nothing to do but to get on with the job along the new lines laid down, but there are many conclusions to be drawn. One of them is that committees here and in some other places are intended to control managements not to be controlled by them; another is that the proceedings of all sections of the Exhibition should be open and above board—little justification can be found for irritating secrecy and no success can attend its use. We trust that it will now be possible for operations connected with this vast undertaking to proceed at full speed. The Empire desire is for the Exhibition to be a huge success, and every bit of littleness must be swept aside in order that that may happen. The electrical industry desires its own large part of the Show to be magnificent, and, like the scheme as a whole, every part of it must be characterised by a broad-minded attitude. Such an attitude on the part of the organisers engenders a co-operative spirit among potential exhibitors, and if everybody electrical in the British industry takes his proper place in the enterprise, we shall be able to command success—both as a combined exhibit and as individual exhibitors who are "out" for business.

The French Electrical Industry.

The shareholders in the Compagnie Française Thomson-Houston on January 22nd authorised the directors to increase the share capital from 200,000,000 fr. to 300,000,000 fr. as and when required. At the extraordinary meeting held on that occasion a lengthy report was presented pointing out the necessity for being financially equipped for participating in the impending great developments in connection with the electrification of the railways, the modernisation of the telephone system, and the extension of hydro-electric works. As for the latter, the report stated that the hydro-electric works comprised 1,500,000 h.p. in 1919; they represent 2,000,000 h.p. at present and will be 3,000,000 h.p. two years hence, and applications for concessions in relation to a further 1,500,000 h.p. are now before the Ministry of Public Works. Speaking on the proposal to increase the share capital by 100,000,000 fr., M. Burrell, vice-president, is reported to have stated that owing to the difficulty of getting together an extraordinary meeting with the necessary quorum required by law, it was essential to have a margin of capital for several years. At the meeting in June of last year it was mentioned that in 1920, which was a year of great activity, the company booked orders for 206,000,000 fr.; in the critical year of 1921 the orders represented 175,000,000 fr.; and in 1922 they were 237,500,000 fr. The orders which had still to be executed on December 31st, 1922, amounted to 222,500,000 fr. as compared with 140,000,000 fr. on the corresponding date in the previous year. Having regard to the extensive programme of the State telephone administration, the company had taken the initiative in grouping in the form of an inquiry company certain financial institutions among the principal establishments in Paris, and the directors had added those of their friends who were specially qualified technically, with the object of facilitating the industrial organisation and development of telephones in France. No idea was entertained by the company of monopolising the deliveries—there was room for all and competition was free—but the figures concerned (2,000,000,000 fr.) were of such magnitude that it appeared advantageous to place the company in the position of being able to deal with the problem under conditions which would render it more easy to carry out. Proceeding to refer to the friendly relations with the General Electric Co., of New York, and the interchange of inventions between the two companies, the vice-president mentioned that the French company had organised at the American company's works an office of French engineers who were entrusted with following all the inventions and improvements emerging from the laboratories and with grouping these for the French central administration, where they were utilised in conjunction with the affiliated companies. In conclusion, the speaker expressed the opinion that the increasing growth of the company's turnover would permit of the maintenance of the financial results for 1923 on the same level as in 1922, when a dividend at the rate of 9 per cent. was paid.

Radio Apparatus and Discounts.

Most prominent in the pages of *The Electrical Contractor* for February is the subject of trade discounts, with special reference to the sale of receivers for broadcast radio-telephony. This is a matter upon which the contractors feel very strongly, for the "N.A.R.M." (National Association of Radio Manufacturers), the membership of which comprises some 220 firms, proposes to allow the full trade discount to any firm, without discrimination, that purchases radio apparatus for resale. The example of other trades is quoted by our contemporary to show that the practice of quoting trade terms to the trade only and not to outsiders is not only the recognised system, but is the only sound basis on which to build up a prosperous business. The immense possibilities opened up by the introduction of broadcasting are admirably expounded.

But the retail trader is rightly warned that only by his own efforts can he hope to secure what we may fairly call his rights; as we recently pointed out, unless the electrical contractor goes into the business with both hands and lays himself out to attract the public by showrooms well equipped with radio apparatus, with a competent demonstrator, he cannot hope to obtain the preferential rates to which he lays claim.

The General Electric Company is singled out by our contemporary as alone recognising, by agreement with the Electrical Contractors' Association, the principle at stake—namely, that the electrical trader shall have a better discount than any other buyer. As the journal states: "The agreement does not mean that G.E.C. wireless equipment must be sold exclusively. But it *does* mean that electrical contractors must go in for the wireless business for all they are worth. Wireless business must be pushed and developed with the utmost vigour." Exactly! It goes on: "We are working to demonstrate to manufacturers and wholesalers that it *pays* to deal through the legitimate electrical trade . . . if we fail, the funeral will be our own."

Our contemporary has hit the nail right on the head. The same comment applies to an excellent communicated article on show-rooms and shopkeeping. We are delighted to see this spirit in the columns of our contemporary; we believe it is on the right track, and we wish success to the movement, carried out on these lines.

GAS ENGINES FOR CENTRAL STATIONS.

Hints on Operation.

By M. S. MASON.

With the advent of the super station, and the "linking-up" schemes that are now in progress, one is apt to consider that the day of gas engines is drawing to a close for central station use, but when the matter is probed, a different light is thrown on it. Of course, the main object of the super station is the reducing of wages and the lower working costs, but a side issue is the saving of the nation's fuel. By the saving in costs effected in time to come, the price of electricity will be such as to be within the reach of all, even for heating and cooking, with the result that, to say the least, gas undertakings are going to have a very much reduced output. The outcome of this will be a shortage and consequent rise in prices of the various by-products which are obtained from the manufacture of gas, amongst which are coke, ammonia, benzine, creosote oil, pitch, anthracine, naphthaline, sulphuric acid, fuel oil, and the by-products which are derived from these, all of which are very essential to the nation.

With the super station, in burning the coal, practically no by-products are produced. Steam is generated and used. Working on one North Country scheme, 22,500 B.th.u. per unit are consumed in its first stage of development, decreasing to 21,560 B.th.u. per unit in its later stages. In an up-to-date gas station 15,000 B.th.u. per unit on town's gas is quite an ordinary figure to obtain. On this figure a large amount of waste occurs, owing to the exhaust gas still retaining a large amount of heat. When the "Bonecourt" boiler is considered in conjunction with gas sets, a much better figure even can be obtained. Consequently, although the gas set has used 7,000 B.th.u. less than the steam, it has left behind, as one could term it, various by-products which are necessary for the prosperity of the country. I do not mean to insinuate that in my opinion gas stations will supersede steam, but that under certain conditions, gas engines still have a future in central power stations. Some years ago a strong line was taken by several engineers in the Press, that in steam stations engineers should start to realise that reductions in cost and better figures generally were not to be obtained by simply having a good man in charge of the engine room, but that proper scientific control should be given to the boiler house. Engineers in a good many gas stations to-day are working under similar false conditions. An old saying used to be: "A boy can run a gas engine," and a good many still work under the same idea. This is why a good many gas stations do not turn out as good a proposition as they ought to do.

We are nearing the days of the perfect steam station, and to obtain the perfect gas station, special attention has to be given to three main points: (*a*) More scientific control of station; (*b*) better display of engineering in maintenance; (*c*) makers of engines to give more consideration, when designing, to running costs of maintenance, and to display better engineering practice, when advising or submitting schemes of lay-out for new plant, particularly to the engineer who is buying his first gas set, and is not aware of the many pitfalls he can fall into.

Referring to (*a*), no good steam man would think of buying coal without first having it tested for its B.th.u., yet how many gas men know the B.th.u. of the product that they are buying? As gas engine makers guarantee their engines on the B.th.u. basis, how can they know whether they are getting the best results obtainable? A recording gas calorimeter should be installed in each station, complete with a recording barometer. It is good practice to have a column on the log sheet for each set, and log the gas per unit for each half or one hour. On turning to the B.th.u. for the hour, the shift engineer knows at once how much above or below the correct figure he is. Without this, he "wakes up" at the end of the shift and finds his gas per unit high, and wonders why.

Whether gas is dear or cheap, it is surprising what a difference takes place under the two different conditions; even assuming the small reduction of 1 cubic foot per unit, when 1,000,000 units are generated with gas at 2s. per 1,000 cu. ft., the saving is £100 per annum. It will be interesting to see the bonus system adopted on the B.th.u. consumed per unit.

As regards (*b*), an eminent engineer once said: "The life of a gas engine is five years." The people who heard, themselves having heard of gas engines which had run twice as long, thought he was "talking through the top of his hat." When one sees the practice adopted in a good many stations, the economical life of a gas engine is certainly not more, but given proper treatment, its reliability is increased, and its life can be safely classed along with that of the steam engine. A few suggestions on maintenance, perhaps, would not be out of place. If you want to enjoy "no trouble runs" and have no serious breakages, follow the old Naval motto: "Open her up to see why she runs so well." Don't wait for the engine to "throw her hand in" before you find the trouble.

Nothing is better than to have your men keep to time tables when possible. Each fourteen days change plugs and examine magnetos. Every 300 hours grind in valves, at 1,500 hours draw lines. If the gas is dirty, this figure should be reduced to 1,000 hours. As regards plugs, I am pleased to be able to state that at last a sparking plug is being put on the market which does away with the objectionable practice of sparking points. This is being done by the Smithbrook Engineering Co., of Chapel-en-le-Frith. This will be welcomed by engineers who are troubled with pre-ignition, due to glowing points, or by those, again, who have realised what a big item these costs amount to in the maintenance account. With regard to the valves, a thing that is commonly ignored is to try a chalk marking on the valve after grinding. Although the grinding shows the valve to be bearing evenly all round, if a chalk marking is tried afterwards, very often it shows the valve to be bearing only on two sides, with a consequent loss of efficiency. When the valve guides begin to wear, renew at once, otherwise the valve will rock on its seat and will tend to make the valve seat round which, if let go, will mean a new seat as well. Do not run valves with a ridge in, grind out the ridge; do not turn it out. Referring to pistons, an old theory used to be to "never touch the carbon under the rings." This is false economy. Admittedly the piston is "tighter" with the carbon, but this is the cause of more wear on the liner of the cylinder, with the consequent result that ridges are formed and the life of the liner very much reduced. It is far better not to let the carbon accumulate beyond a certain amount, and as soon as the ring begins to tighten, remove it, and clean. Piston rings should not be allowed to run with knife edges. They should be chamfered off on both sides, otherwise the knife edge acts like a scraper on the liner and wears it away, and also the knife edge keeps back too much oil, the top ring running very dry. On a vertical engine do not leave the ring joints either at the front or the back, but on the sides, where there is no piston slap. These are a few of the essential things that need careful watching, and if the same attention is given to the rest of the engine

no trouble will be the result. Two other points I should like to mention—one is oil and the other water.

A good many engineers have failed to realise the essential importance of obtaining a perfect oil. Price does not have to be considered in gas engines of the vertical type. There are two classes of lubricating systems adopted; one is forced lubrication for crank case, and a special lubrication for cylinder; the other is forced lubrication for crank case, and splash lubrication for cylinder. Of the two, I prefer the latter. In the former, one naturally buys a gas engine crank case oil, and a gas cylinder oil for the special lubrication, with the result that not being able to keep all the splash out of the cylinder, trouble arises from the oil not being suitable for cylinder lubrication; also, when the cylinders are separately fed, the lubricating pipe has to pass through the water jacket. I know makers have given special attention during the last few years to this point, but I, personally, have seen more than one cylinder cover cracked through water getting into the cylinder *via* the oil pipe during standing, with the result that away goes the cylinder cover and the piston is cracked on starting. With the latter type of lubrication, only one class of oil is used. This oil should be of a special nature. It should have good viscosity, have a high flash and fire temperature, should be fairly heavy, and be very nearly a pure hydrocarbon. Unless the oil is of this nature you will get explosions in the crank case, carbon in large quantities in the cylinder, pre-ignition, wearing of cylinder walls, to say nothing of bad gas consumption. A good many oils break down very quickly through the engine having to run long hours, and the oil not getting a chance to cool. Why don't makers realise that engines in power stations have to meet this duty, and fit a cooler in the crank case in connection with the ordinary cooling arrangements of the engine? A good practice is to draw off a bucketfull or so each day and filter it. By doing this, the oil will not break down so rapidly. As regards water, not enough attention is usually shown in maintenance. Many engineers open up every other part of the engine from time to time, but never the waterways till they have to.

It must be kept in mind that deposit is gradually collecting at the bottom of the jacket and in other places, and unless this is cleared, local heating will take place, which, if bad, will certainly mean a cracked cylinder.

Referring to (*c*), makers as a whole show a lack of men on their staffs who have had experience in running gas engines. These are all made correctly, no doubt, from a size or construction point of view, but many lack points which are the making of engines from a maintenance point of view, *e.g.*, one maker evidently has no idea that in cases where the gas is dirty and tarry, carbon deposit has to be removed in some places as often as every seven days. To remove this on the engine referred to, you have to lift all cylinder covers, and break most water joints, which, on a 4-cylinder engine, takes perhaps six or seven hours. On the same engine there is an inspection plug on one side of the engine, and if only they had fitted another one where the indicator cock is, carbon deposit could be removed from the four cylinders in, at the most, one hour. One could go on pointing out facts like these for some time, yet makers fail to realise that a central station, unlike some of the private works, shows a cost sheet, and the big items in some cases set down for maintenance of machinery are apt to frighten off a good many engineers. Also, when the makers are advising for new plant, if they will only realise that "reliability" is the chief thing, when all is said and done, there will be a good many more gas engines running than there are to-day. For one instance, makers supply a circulating pump, belt driven. There being no other means of feeding the engine, the first time the belt goes west, you have either to shut the town down or crack a cylinder. I saw another glaring case of bad lay-out some time back. The engine took its air through a 3-in. pipe running from the outside air, about 50 or 60 ft. high. Engineers could not make out why it pumped, banged, and shook the whole building. They did everything, from new liners and pistons to shrinking a new boss on the fly-wheel. When I took over the plant, the engine was on the scrap heap practically, the insurance people having certified her not safe to run. I tried her the second day I took over, and after going over other things I cut a hole a foot long in the air pipe, near the engine, then tried her. The engine was O.K.

How many makers of gas engines of the multi-cylinder type, and also of other multi-cylinder internal-combustion engines, realise that half of the back firing which takes placed is caused through induction in the ignition cables when the cables are run together? Engineers who read this would do well to disconnect one cable at each end and to put a sparking plug on to one end, laying it on the engine. The plug will then be seen to fire. The effect is that at certain loads back firing occasionally takes place and at others often pre-ignition. The cables should be at least 2 in. apart. Of course, it does not matter if there is induction from another cable as long as one of the two cables does not fire while the other is on a suction stroke.

As regards choice of engine for station use, personally I prefer the four-cylinder vertical. When buying a gas engine one naturally wants to obtain the lowest cost of maintenance, and, at the same time, to be able to have a steady light. Speeds vary on different makes, but I myself recommend a speed of about 350 revs. If you go higher, there is more wear and tear. If you reduce it to get less wear, you will find that the pulsation on lights is noticeable. Of course, a battery helps to stop this. This brings me to my last point. Engineers would do well to follow the rule of having as large a battery at the one-hour rate as the largest set.

This battery should be connected up either with an automatic reversible booster or on the "Canterbury" system, with automatic battery regulation on both charge and discharge. When this is adopted, never mind what happens, within reason—as long as the machines have reverse current breakers, the board will look after itself while the shift engineer can give his full attention to the trouble.

Coal Smoke.—"Only those who live in towns can fully appreciate the many drawbacks due to the coal smoke which most of the dwellers in them produce in their domestic fireplaces. This pollution of the atmosphere very appreciably increases laundry bills and bills for decorating purposes. It also, we think, shortens life. As gas or electricity can now always be used to heat buildings in towns, Dr. Russell thinks that the time has come when coal consumers should be penalised. He thinks that some form of soot-precipitation plant should be made compulsory on all coal consumers, and evidently thinks that an electrical device for this purpose could easily be perfected. Once we got rid of coal smoke then every town house could have its roof-garden, and the savings effected in laundry and decorating bills would more than cover the cost of soot-precipitation plants. Towns would be ever so much pleasanter and healthier to live in. It is obviously much better policy to prevent the causes of fogs than to invent remedies for the fogs themselves."—*Faraday House Journal.*

The Society of Arts Installation.—The Royal Society of Arts building has recently undergone considerable alterations and a new electrical installation is one of the improvements. The building is supplied by either the Charing Cross Co. or the London E.S. Corporation, and the lighting has been so arranged that in case of a breakdown on one company's system, a supply can be obtained from the other. The main lighting of the meeting room consists of four 300-W gas-filled lamps in 24-in, alabaster bowls fitted with lowering and suspension gear and safety nets. The lighting of the entrance hall, staircase, library, and other important parts of the building is also carried out with alabaster bowls and gasfilled lamps. The glass dome of the great meeting room has been fitted with an umbrella-like screen which is operated by a motor-driven winding gear supplied by the Express Lift Co. Ventilation is by a 24-in. Keith Blackman exhaust fan placed in the inlet of a large trunk running round the roof, four ceiling inlets communicating with the trunk. Edmundson's Electricity Corporation was responsible for the lay-out and execution of the electrical work

E

SOME NOTES ON CHANGING OVER A NETWORK FROM D.C. TO A.C.

By M. FARRER, M.I.E.E.

There are a large number of undertakings in this country whose networks consist of V.B. cables laid solid in bitumen in wood or stoneware troughing. In most of these undertakings a considerable amount of trouble has been experienced with this system of cable laying, and in many undertakings the trouble has become so serious and the cost of repairs has increased so enormously that it has been considered advisable to scrap the greater part of the V.B. network and replace it by lead-covered and armoured cables.

This has, of course, involved very heavy expenditure, and most undertakings faced with the heavy cost of material and labour have shrunk from taking such drastic steps.

In a discussion before the Institution of Electrical Engineers some years ago, Mr. Vernier referred to this trouble, and gave his solution of it, which was to change over the whole system to single-phase working. Mr. Vernier found that faults practically disappeared from his system, while the few that were still experienced were not severe in character and did very little damage.

The writer was much impressed with the facts and figures as given by Mr. Vernier, and has since been waiting an opportunity to carry out a similar experiment on his own system. Such an opportunity recently arose, and the object of this article is to describe briefly the procedure followed in making the change and to give a few figures as to costs.

The district chosen was the eastern end of Twickenham, situated at an average distance of 1¼ miles from the generating station, and hitherto fed from a h.p. d.c. sub-station containing rotary transformers supplied with direct current at 2,500 volts and remote-controlled from the generating station. The distributors in the district were also linked up generally with the central area. The distribution pressure is 480 and 240 volts on a 3-wire system.

The reasons for selecting this area were:—

1. The d.c. h.p. transforming plant was overloaded, and extensions had become inevitable.

2. H.p. 3-phase feeders at 3,000 volts were already in the area.

3. The district was mainly residential, and the motors to be dealt with were neither numerous nor large in size. (The one large factory in the area was already taking an a.c. supply.)

4. The condition of the V.B. cables in this area was, on the whole, rather worse than in other areas.

The distributors in the area in question were all 3-wire distributors, the prevailing sections being 0.05 in., 0.03 in., 0.05 in., and 0.10 in., 0.06 in., 0.10 in.

It had first to be decided which method of distribution was most likely to make the best use of the available copper in the distributors and likely to give the best balance.

Four systems were considered:—

1. Three-phase, 4-wire (already in use in the undertaking's outer areas).

2. Three-phase, 3-wire.

3. Unsymmetrical 3-phase system forming two legs and neutral of a 3-phase star.

4. Single-phase, 3-wire.

1. *Three-phase, 4-wire system.*—This would have involved laying a single additional cable alongside the existing cables and transferring a sufficient number of consumers to the new cable to give approximate balance.

Very heavy expenditure would have been necessary, and, in view of the condition of the existing cables, it was at once put out of court.

2. *Three-phase, 3-wire system.*—This system had the advantage that it would allow 3-phase motors to be connected to the system, but was handicapped by the small neutral cable, and gave a very poor utilisation of the available copper. Motors would also have to be connected at the lighting voltage.

3. *Unsymmetrical 3-phase.*—No advantages to justify its consideration.

4. *Single-phase, 3-wire.*—This system had the great advantage of giving equally good utilisation of the copper as in the d.c. system, and no alterations to consumers' services were involved.

The chief problem would be to split up the various sections of the distributing system so as to give reasonable balance across the 3-phase system.

Only single-phase would be available for motors, but the motors could be supplied at double the lighting voltage.

It was decided to adopt this system, and the next point to be considered was the best method of splitting up the existing network.

The three chief factors to be considered were:—

1. To obtain a fair balance as between lighting consumers.

2. To obtain a fair balance as between power consumers.

3. To obtain the above with a minimum expenditure on new feeders, links, and alterations of network boxes, &c.

At the same time, the arrangement had to be such that it would be possible to change over from d.c. to a.c. section by section, and maintain in the intermediate stages a reasonable voltage on both systems.

As already stated, there was only one sub-station feeding this area, but, on the other hand, the system was linked up at several points with the general network in Twickenham both by feeders and distributors.

Once the district was changed over to a.c., these links with the remainder of the district would, of course, be lost, and, owing to the small size of the distributors, it was not considered possible to feed the district from one sub-station without the expenditure of a considerable sum for new feeders.

It was, therefore, decided to fit up a second sub-station to help supply the N.W. part of the area.

As an alternative to a sub-station, the employment of a kiosk was considered, but the writer's experience of kiosks for h.p. supply has not been altogether satisfactory. Space is, as a rule, very limited, and the blowing of a h.p. fuse often causes a great deal of damage. In addition, the handling of the switchgear in wet weather requires great caution. The removal of a transformer in case of failure is also none too convenient an operation.

Underground pits were also rejected for somewhat similar reasons.

Attempts were made to secure the use of some existing cellars which projected out under the roadway, but these being unsuccessful, it was decided to build. A piece of land 24 ft. × 9 ft. was fortunately available, and this was purchased for £50, and a brick sub-station erected on it. This sub-station, measuring 20 ft. 3 in. × 7 ft. 8 in. internally, although built in the early part of 1921 when building costs were at their highest, was erected complete for £210. The walls are of brickwork, with a sloping lead roof and concrete floor. Sliding doors are fitted, and also a small wicket door.

There is ample accommodation for two 200-kVA transformers and all necessary switchgear, but at present only one 100-kVA transformer is installed.

The total cost of the sub-station, including land, and equipped with switchgear and one transformer, was £792.

The maximum load in the h.p. d.c. transformer at the existing sub-station was 120 kW, but to allow for the load picked up from the network, a maximum load of 200 kW was assumed for the area.

To deal with this, two 100-kVA transformers were installed at the existing sub-station and one 100-kVA transformer at the new sub-station, the intention being that the third transformer would be available for use at either sub-station in case of need.

The transformers are 3-phase, mesh-connected on the primary and 6-phase star-connected on the secondary side, and with the star point brought out.

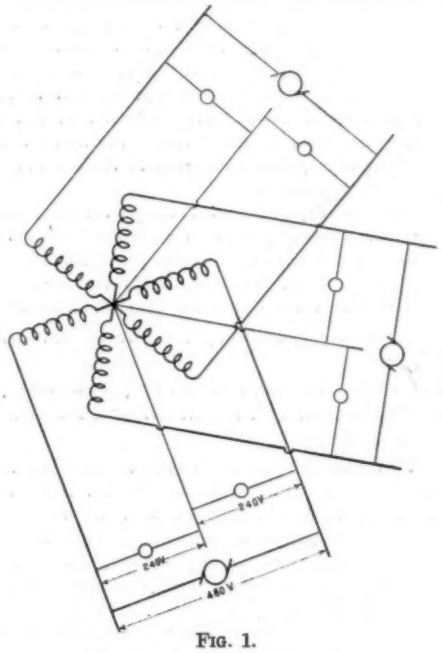


Fig. 1.

Fig. 1 shows how groups of 3-wire distributors are fed from the secondaries of the transformer.

In certain cases it may be preferable to use single-phase transformers, either banked together or fixed at different points on the network as may best suit the distribution of load and other local conditions.

For reasons of simplicity and economy it was decided to dispense with oil switches altogether and use fuses on both the h.p. and l.p. sides. "S. & C."-type fuses made by Electric Control, Ltd., of Glasgow, were adopted. The construction of the fuses is as follows:—

The fuse is contained in the upper part of a glass tube filled with carbon tetrachloride, the fuse being protected from contact with the liquid by passing through a cork; one end of the fuse is connected to a strong spring.

When the fuse blows, the spring contracts, draws out the arc, and at the same time the liquid is forced into the gap, so extinguishing the arc. It is claimed that these fuses have successfully cleared a short circuit on a 66,000-volt circuit with 18,000 kW behind it.

The h.p. cable is terminated at one end of the building in a trifurcating box; V.B. insulated cables are taken direct to combined link isolating switches and fuse mountings.

From the fuses the cables are carried in Doulton racks to the transformer or transformers, which are placed in the middle of the building. From the l.p. side of the transformer, seven V.B. cables are carried in racks to the l.p. switchboard at the end of the building remote from the h.p. gear.

The l.p. switchboard consists of "Henley" distributor units bolted top and bottom to angle irons set into the walls. These units consist of two parallel micanite-covered steel tubes coupled together at top and bottom. Upon this frame the fittings carrying the bus-bars and the porcelain fuse carriers are mounted.

The arrangements of the bus-bars and connections are shown in fig. 2. It will be seen that provision has been made for an additional set of fuses should an additional transformer be required. The star point is earthed direct through a knife switch.

The arrangements for dealing with consumers require careful organisation, to avoid any unnecessary inconvenience. Before a change of system can be made it is necessary to obtain the consent of the local authority. In the event of difficulty arising, there is a right of appeal to the Electricity Commissioners.

Consent having been obtained, it is advisable to send a circular letter to all consumers, stating that the change is about to be made and that meters, motors, and other appliances will be exchanged or altered at the undertaking's expense.

The letter should inform consumers that the undertaking will not be responsible for the exchange or alteration of any motor or appliance purchased after the date of the letter, unless with the consent of the undertaking. The letter should also state an approximate date for the change.

A house-to-house inspection should then be made in the area affected, and schedules should be prepared showing the number, size, and type of meters, and details of any motors or motor-driven appliances. The details with regard to motors should, of course, include speed, size of motor pulley, size of driven pulley, and details of fixing; also a note of anything restricting alterations in the size of pulley, such as lack of clearance between shafting and wall, &c.

From these preliminary details a schedule can be drawn up giving against each power consumer details of the proposed single-phase motor, with the size of driving and driven pulleys required to give approximately the same speed.

By utilising three standard motor speeds, it was found necessary only in one case to alter the size of the driven pulley. In all other cases the speed required was obtained by variation from the standard size of the motor pulley.

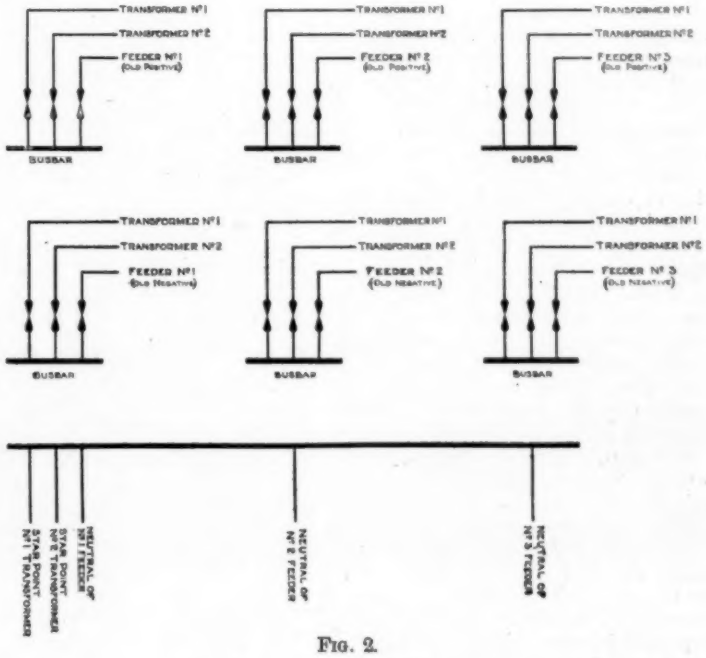


Fig. 2.

From the above-mentioned schedule the necessary motors can be ordered, with the correct pulley for each job.

(To be concluded.)

THE THEFT OF ELECTRICITY IN DOMESTIC SUPPLY.

By J. R. WILLINGHAM.

A recent article* describing the employment of a metal-sheathed cable for the purpose of effecting the necessary connection between an undertaking's supply mains and the meter on a consumer's premises touches upon a matter of extreme importance, and opens up a subject that demands attention in manufacturing circles.

The practice of making the aforesaid connection by means of ordinary rubber-covered cables is literally inviting the person of a dishonest tendency to exercise his ingenuity in diverting the path of the current through the meter by inserting a couple of pins through the insulation and bridging them across with a piece of fuse wire.

Again, some types of fuse boxes are admirably designed to admit of a further lead being introduced through the top bushing or outgoing end, thus creating a separate circuit altogether, sufficient contact in this instance being secured by "wangling" the bare end of the extra lead inside the fuse box until the desired purpose has been achieved.

In either of the above cases little electrical knowledge is required in order to indulge in these practices, especially as v.i.r. lends itself to the reception of pins, &c., without leaving a very conspicuous impression; the wary one being careful to conceal all traces of his act, it is seldom that the inspector can secure a "cop."

It is obviously impossible to expect the meter readers to examine every inch of wire at each call, and in cases where fraud is suspected, it seems reasonable to consider the adoption of some means effectually to meet the condition without any undue extra expenditure being involved.

It might be mentioned here that in some cases the undertakers themselves are entirely to blame. The author has in mind a case that he was once called in to investigate, where wholesale theft was alleged to be taking place; a careful examination of the meter and leads for the usual signs revealed nothing, but going a little further and looking over the installation, a switch without a cover was discovered. This switch controlled a 3-light fitting in the living room. Closer inspection revealed that the switch in question bore signs of being in the last stages of dilapidation, one side of the blade being missing altogether.

An inquiry elicited the information that "one night last winter" a "sizzling" noise from the switch, accompanied by a marked diminution in illumination, was observed. The "young idea" (aged 13½) proceeded to investigate, and having discovered accidentally (by means of the switch cover coming momentarily in connection with one contact and the conduit at the same time) that the lights lit up "grand," could see no reason why this newly-born knowledge should not be turned to serviceable account.

A familiar object in electrical circles—that ever-popular "short-notice" fuse replacer, the innocent hairpin—was once more taken advantage of, suitably bent at one end, inserted in the side of the contact and made to turn to the angle required just to catch under the base of the switch which was screwed to an end box provided a ready "by-pass" for the current *via* the conduit to "earth." A little further examination brought to light the fact that the meter was inserted in the *neutral* main, the system being 3-wire d.c.

No apology is considered necessary in this instance for failure to provide a sketch depicting the condition of affairs as far as the meter was concerned. This is a typical case of how a consumer may, without (perhaps) having any ulterior motive, derive considerable benefit at the supplier's expense.

* Electrical Review, January 5th, 1923, p. 4.

From the foregoing it should be evident that before deciding to adopt any fraud-proof devices in the meter connections, engineers in charge of systems possessing an earthed conductor would do well to make a point of first of all ascertaining whether or not all the meters are connected in the "live" main, and with 3-wire d.c., paying special attention to those services connected to the negative side.

The war was responsible for many things; amongst others it undoubtedly produced in some cases a type of meter-fixer who invariably arrived at definite conclusions as to the correct connections for meters generally, by one or other of the following simple methods:—

1. By *accidentally* touching the "live" side with the fingers.
2. From the evidence produced by pole-finding paper.
3. From observation of the direction of rotation of the meter disk.

Probably the last-mentioned found the greatest favour.

No blame can be attached to anyone for this, it being fully realised that the meters had to be installed *somehow*, and, owing to circumstances over which they had no control at the time, supply authorities were compelled to carry out such work with whatever labour they could find for the purpose, the matter being simply mentioned as a reminder to those whose war-time conditions were as detailed above.

It has been suggested that a type of combined unit comprising both meter and cut-outs in one case be employed. No doubt this would decrease the tendency to actual theft, but there are many disadvantages from the undertaking's point of view.

It must be remembered that the meter itself requires periodical attention at the hands of the testing and repair staff, and this work cannot, as a general rule, be effectually carried out on site, some concerns preferring to change the meter altogether at intervals.

If therefore such a unit has been made up by a firm of meter manufacturers, it is pretty safe to assume that no other type of meter but that originally supplied can satisfactorily be made to fit the box.

If the supply is fed from an overhead source, it may be possible to change box and all with a minimum of trouble; but where the cable is led in underground to a sealing trough (which of necessity would have to form part of the outfit), the proposition is not quite so simple. Again, there is the question of future extensions to be considered, which means in most cases additionel meters. How are the boxes to be suitably coupled together so as to be easily accessible and at the same time admit of no visible conductors?

To those who favour such an arrangement, the author would suggest a sealable cover with glass windows in front, and fixed direct to the meter-board by means of screws, thus enclosing the whole apparatus; such covers could be made up to suit the various sizes of meter-boards most commonly used, and would have the advantage of further protecting the meter and fuse boxes against mechanical damage, while at the same time allowing meter readings and inspections to be carried out in the usual way.

Before, however, finally resorting to such methods for the prevention of fraud, why not give the following further suggestions a trial?—

(1) Install service cut-outs having the outgoing bushes capable of being bored or plugged to the actual diameter of the leads employed.

(2) Insist on meters being provided with sealable terminal covers that not only cover the terminal block itself, but the two bottom fixing screws as well.

(3) Use ordinary *single* metal-sheathed cable for the connections between cut-outs, meter, and consumer's main switch in the usual way, taking care that the sheath is carried well up inside the meter terminal cover (the type mentioned above usually allows of this).

(4) Bond and earth the sheath and seal up the meter and cut-outs in the ordinary way.

Any attempt to perforate or tamper with the leads or meter can at once be detected; a "shorting out" by this means of the meter leads will result in the fuse blowing, owing to the sheathing being earthed.

The author recommends the colouring of all service cut-outs corresponding to the main they are fed by, *e.g.*:

Positive main ... Red; Negative ,, ... Blue;
Neutral ,, ... White;

or any other combination preferred. The same would, of course, apply to polyphase systems, either two-, three-, or four-wire.

In conclusion, it would be perhaps interesting to remark that in many installations the plugs, &c., are identical for both lighting and heating purposes, and no trouble is experienced in connecting, say, a standard lamp or other light attached by a flexible cord to a plug top, to either a lighting or a heating circuit; as the latter rate per kWh is usually far below that charged for the former, the undertaking stands the risk of further revenue losses, and this, again, is deserving of attention.

A TRAIN CONTROL BOARD ON THE L. & N.E. RAILWAY.

The new main-line control board, recently put into operation in the General Superintendent's office at York, differs from other existing controls, in that it includes in its operations not only freight, but passenger trains.

The object of the control board is to enable the control staff to ascertain at a glance the condition of the traffic on the various lines, and for this purpose the board is fitted with a number of cords working on the endless belt principle at varying speeds, corresponding, as far as possible, with the varying speeds of trains which pass along the line.

Each train is represented by a carrier, which is placed on its appropriate cord, as the train enters the control area, and the carrier travels along on the cord at a geared speed, past the various stations, signal boxes, &c., which act as reporting stations and which are indicated on the board by means of letters and names.

The board, which shows the position of every signal box and station, is drawn to a time scale, and shows the running time in minutes between signal boxes. A list, including every booked passenger train, showing its number on the working time-table, and its running from point to point, is also given on the board, so that the controller has no difficulty in deciding on which cord the carrier should be fixed, the speed of the cord as between each pair of places being indicated on the board also.

At intervals, which coincide with various stations where there are reporting points, brass stops are fitted on the board to prevent the carrier getting past the reporting point before the train is actually reported, and the brass stop or the lever released by the controller. Consequently if a carrier is moving quicker than the speed of the train, it will be checked by this automatic stop. Similarly, if the train is running quicker than the speed of the cord, the controller's attention is immediately drawn to this when the report is received, and the carrier is moved along for a new start.

The electrical equipment of this ingenious arrangement plays a very important part. There are six main-line circuits of telephones operated on the Western Electric Co.'s selector principle, by means of which the control is in direct communication with the yard masters, station masters, &c., and the various district superintendents' offices, which occupy three of the circuits, while the others are used exclusively for the purpose of train reporting.

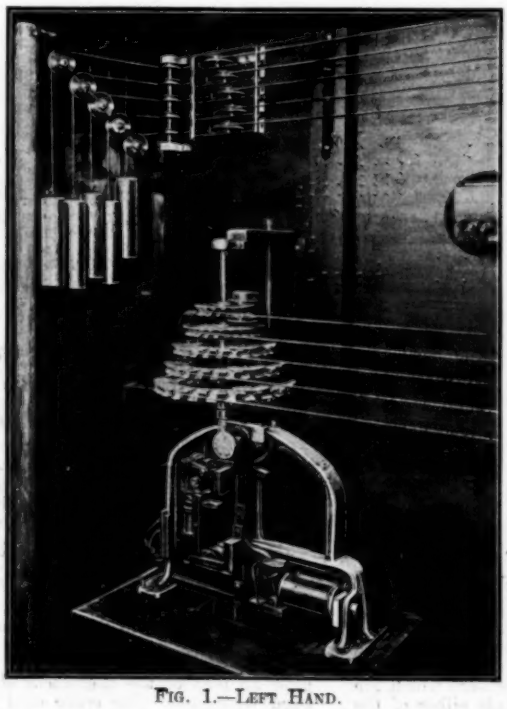


Fig. 1.—Left Hand.

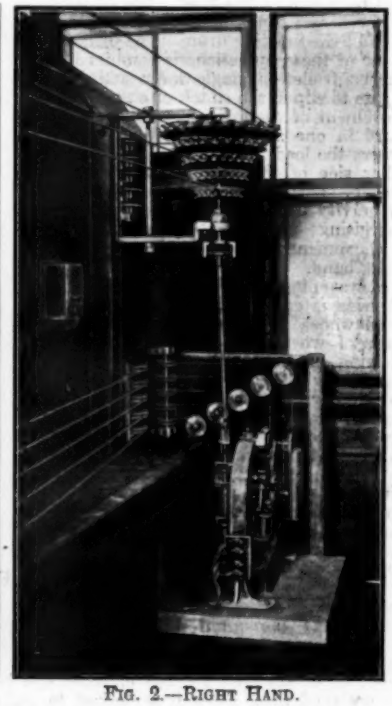


Fig. 2.—Right Hand.

Back View of Train Control Board, showing the Waiting-train Movements, Endless Cords, and Tensioning Devices.

The method employed for driving the endless cords is of special interest. The problem was to devise a method of drive that would ensure a constant cord speed under varying conditions and at the same time maintain perfect synchronisation between the respective cords. This difficulty was overcome by adopting Messrs. Gent and Co.'s well-known "Waiting-Train" method of drive, shown in the accompanying views of the arrangement at the back of the control board.

As will be seen, the cords are driven by pulley wheels

of different diameters, and are kept taut by means of weights. The motive power employed to drive the cords comprises two "Pulsynetic" waiting-train movements. In these movements the energy supplied by a reciprocating pendulum is communicated to the vertical spindles by worm gearing.

The pendulum carries with it a trailing nib, which normally passes over a notched block. When the arc of vibration of the pendulum falls below a certain value, the trailing nib catches on the notched block, and on the return swing of the pendulum forces two springs into contact, closing the circuit of an electromagnet, which imparts a mechanical impulse to the pendulum and so keeps it swinging.

In the event of any increase in load on the cords, due to friction or other causes, the pendulum will take current as often as required, and consequently maintain an even speed irrespective of load.

Perfect synchronisation between the two driving movements is ensured by controlling them with a "Pulsynetic" impulse transmitter, which is also used for impelling the electric clocks fixed on the face of the board for timing the trains. The apparatus for this purpose was designed and manufactured by Messrs. Gent & Co., Ltd., of Leicester.

THE "RANSOME" CRANE AND ELECTRIC TRUCKS.

The "Ransome" electric runabout crane, manufactured at Ipswich by Messrs. Ransomes, Sims & Jefferies, Ltd., has been improved in a number of respects since it was described in the Electrical Review of October 21st, 1921 (p. 545), and the improved design was inspected by a party of Press representatives on February 5th, when the capabilities of the crane were demonstrated in a number of ways. Three sizes are made, to deal respectively with maximum loads of 20, 15, and 7½ cwt. The body of the machine remains the same in each case, the difference lying in the jib, which is manufactured by Messrs. Ransomes & Rapier, Ltd., Ipswich. The motive power is provided by a battery of 20 or 40 cells (129 or 258 ampere-hours capacity). Two 1.25-h.p. series motors form the driving units. These are mounted at the sides of the crane and, running at 1,100 r.p.m. normally, drive, through a 17½ to 1 reduction gear, the outside wheel of a pair mounted on either side of the body. The other wheel of each pair is an "idler," and the wheels are articulated so that although the driver may be raised by an obstruction, the weight will still be borne by the idler. The hoisting motor is of 3 h.p., and operates both the jib and the hoisting drum. The management of these operations is combined in one controller—a single lever acting in a gate to slip in the clutch of either gear. Movement of the lever forward or backward in one side of the gate hoists or lowers the load, while movement on the other side of the gate raises or lowers the jib. It is also possible to lower loads by gravity under perfect control without energising the motor. The controller is conveniently placed at the operator's right hand. On his other hand is fixed the travelling and slewing controller. Steering is effected by means of a large hand wheel, which is geared to the two pairs of wheels at the front and back. Slewing can only take place when the steering wheels are set at right angles to the driving wheels. When this position is reached an electrical contactor gear is brought into operation automatically by the steering gear, causing the two driving motors to rotate in opposite directions as soon as power is switched on by movement of the controller, thus slewing the crane. The hoisting and derricking motor drives the respective rope barrels by means of high efficiency worm and spur gearing, the drives being by a special patent mechanism which affords the maximum simplicity of control, at the same time securing high efficiency of operation and safety in braking. This mechanism consists of an arrangement of ferodo-lined friction clutches and brakes, which are so designed that, when it is desired to operate either of the motions, the brake by which the load is normally secured is progressively released as the clutch is applied, and—*vice versâ*—the brake is progressively applied as the motion is stopped by withdrawal of the clutch. Apart from simplicity and smoothness of control, this arrangement also possesses the advantage that, as the motor is common to both the hoisting and derricking motions, it is automatically started and stopped as the clutching is performed, thereby securing an economy of energy which would not be the case were the motor to be left running, as frequently happens in clutch-operated cranes. The mechanical progressive braking above described also obviates the necessity of electric brakes, which, in the case of a motor operating two distinct motions would require special switching arrangements. A powerful foot brake is provided for use in regulating the motion of the crane, either when slewing or when moving from one point to another.

Fig. 1.—The "Ransome" Runabout Crane and an Industrial Electric Truck.

As the driver has the means of controlling all the motions of the crane from his seat, and has a clear, uninterrupted view of the load, the operations of simultaneously travelling and hoisting, travelling and derricking, slewing and hoisting, or slewing and derricking can be carried out with perfect ease.

The battery, from which the power for the motors is derived, is contained in two detachable boxes, which are situated at the rear of the crane, near the base of the jib, and thus act as a counterweight to balance the load. The approximate weight of the largest size is four tons; the other sizes weigh 3½ tons each. The hoisting speed naturally varies inversely as the size; in the largest crane it is 30 ft. per minute, rising to 40 ft. for the 15-ton crane, and 80 ft. for the smallest size. The travelling speed for all sizes is 300 ft. per minute. The maximum length of the carriage over wheels is 7 ft. 6 in., and the maximum width is 5 ft. 3 in. The radii at which loads can be lifted are 10 ft. max. and 5 ft. 6 in. min. for the largest size, and 16 ft. 9 in. max. and 9 ft. 6 in. min. for the smallest size. The largest crane can lift a load from a depth of 6 ft. below ground level, and the equivalent depth for the smallest size is 25 ft.

The first part of the demonstration at the Orwell works gave an idea of the usefulness of the crane in a medium-sized warehouse. The crane used was the 15-cwt. size, and the ease of control was seen to be remarkable. The crane possesses the advantage of flexibility to a degree not possessed by the usual runway hoist. Another point demonstrated was the ability of the crane to rotate within its own diameter—the variation from a true circle was scarcely perceptible. The advantage of articulated wheels was displayed by passing one of the outer driving wheels over a wood block, when the flexibility of the mounting was seen, the inner wheel remaining on the ground, although the outer one was raised two or three inches. The next feature to be demonstrated was the ease with which the crane could be taken through a narrow doorway. The application of the crane to the moving of timber was also shown to the party.

In one of the machine shops at the works the crane was used to place a base-plate weighing about 12 cwt. upon the bed of a planing machine. This, and the placing of a 15-

cwt. crank shaft between the centres of a lathe, showed how fine an adjustment could be arranged. The crane was then taken over a length of muddy and rough roadway in which were laid railway tracks. It successfully passed this rather severe test, and then proceeded to perform some actual work in unloading 12½-cwt. ploughs from an electric vehicle into a railway truck ready for dispatch.

There seems to be no doubt that in this runabout crane the firm possesses an appliance which will lighten works transport costs in many branches of industry.

While at the works the visitors also saw a number of industrial electric trucks in action. The firm manufactures twelve standard models differing in the following respects:—Long or short platforms; two- or four-wheel steering; fixed or elevating platforms; and low or high platforms with 10 in. or 16 in. diameter trailing wheels. For special applications further varieties have been developed, but the following details apply to all the standard models. There are two totally-enclosed, series-wound, 1-h.p. motors, bolted to the front swivel axles of the truck, driving the wheels through double helical gears. The trucks are made to carry a weight of two tons. The battery consists of 20 lead cells, with a 120-Ah capacity, allowing of an average mileage of 15 miles on one charge. The speed varies from 4 or 5 m.p.h., loaded, to 6 or 7 m.p.h. unloaded, and the trucks can negotiate a 1 in 9 grade when fully loaded. The combination controller is situated at the front of the truck, and contains all the gear of the electrical control, the reversing drum, operated by a hand lever, the speed-control drum fitted with a magnetic blow-out and operated by a foot pedal, the regulating resistance, and a standard charging plug. On all models are fitted external contracting band brakes operating on special drums keyed to extensions of the armature spindles. The steering is done by an arm which acts on centrally-pivoted steering wheels. The control is rendered safe by the action of the pedal. When this is released the motors are cut out and the brakes applied, and the reversing drum automatically returns to neutral. Before the pedal can again be depressed, the control lever must be moved from the "off" to the "forward" position. The downward movement of the pedal cuts out a starting resistance step by step in four movements.

In the elevating-platform type of truck the elevating gear consists of a revolving screw in a cylinder which has a limited travel sufficient to raise a load clear of the ground.

The accompanying illustration (fig. 1) shows both the runabout crane and an industrial electric truck.

LONDON AND HOME COUNTIES ELECTRICITY DISTRICT.

Draft Order of Constitution.

It will be remembered that the provisional delimitation of the above-named district was followed by the submission of a number of schemes for the improvement of the existing organisation for the supply of electricity in the area, which were considered at a local inquiry. The result was that while the Electricity Commissioners concurred generally in the technical proposals for the first stage of development, they differed from the promoters on the proposals for the second stage, and published alternative proposals.

The Commissioners have now issued a draft order constituting the district and establishing and incorporating the London and Home Counties Joint Electricity Authority. In connection therewith a local inquiry is to be held at the Institution of Electrical Engineers on March 12th, and any representations or objections should reach the Commission not later than March 3rd, 1923.

The draft order proposes that the Joint Authority shall remain as already specified, except that the railway companies are given two instead of one representative, and the chairman shall not be appointed from amongst the members of the Authority. The chairman shall on his appointment become for the purpose of the scheme an additional member of the Authority; he may be remunerated and travelling and subsistence expenses may be paid to the members of the Joint Authority. The latter shall appoint Technical and Finance Committees and may appoint other committees; at its first meeting the Joint Authority shall appoint a Local Authority Committee (to consist of eight members elected by the local authorities represented on the J.E.A., 15 of them being within and 19 without the Administrative County of London) and a Company Committee (to consist of six members elected by the 13 company undertakers within the Administrative County of London). These two Committees may appoint chairmen who may be remunerated, and to them the J.E.A. shall delegate its powers and duties relating to the (1))generating and transmission of electricity and bulk supplies to authorised distributors; (2) management and operation of certain generating stations and main transmission or interconnection lines transferred or leased to the J.E.A.; (3) carrying into effect of certain portions of the technical scheme and other works which may be apportioned to them; (4) management and operation in accordance with a scheme of allocation determined by the J.E.A. and approved by the Commissioners of generating stations and main transmission lines acquired by the J.E.A., or constructed by the Committees on its behalf; (5) negotiating for bulk supplies on behalf of authorised distributors outside the Administrative County of London, if so required by such distributors, with any authorised undertakers empowered to give such bulk supplies; (6) power to incur expenditure on capital account within the limits of estimates submitted by the Committees to the J.E.A. and approved by the Commissioners; (7) power to incur expenditure on revenue account; (8) powers of fixing prices to be charged for electricity and the obligations under Sub-section (1) of Section 18 of the Electricity (Supply) Act, 1922; (9) other powers and duties specified in the draft order.

The powers and duties delegated to the two Committees shall continue to be exercised by them until such time as the whole of the generating stations and main transmission lines to be transferred or leased to the J.E.A. shall have become the absolute property of the J.E.A. The two Committees shall report their proceedings to the J.E.A. The portions of the Administrative County of London within which the Local Authority Committee and the Company Committee respectively are to exercise the powers delegated to them by the J.E.A. are indicated on the accompanying map.

The Joint Authority shall allocate all moneys borrowed or raised by it to meet the requirements of the Local Authority or Company Committees to those Committees respectively and those Committees shall be charged by the Joint Authority with the sums required to meet the interest and the repayment or sinking fund instalments in respect of the moneys so allocated.

Fig. 1.—The Administrative County of London.

In the event of any deficiency arising in any year on the revenue account of either the local Authority or the Company Committee such deficiency shall be provided for by the Committee concerned.

The accounts of the Joint Authority, the Local Authority Committee and the Company Committee shall be kept separately, and the J.E.A. from such accounts shall prepare an annual statement of accounts as may be prescribed by the Commissioners.

Every power to purchase any undertaking which is vested in the London County Council or in any local authority within the district shall be transferred to the Joint Authority and shall be suspended for a period of (40) years from August 26th, 1931, in respect of the electricity distribution systems within the Administrative County of London including the trans-

former stations and all cables, mains, feeders lines, and apparatus forming an essential part of those distribution systems. The dividends payable on the capital of those companies in respect of whose electricity distribution systems the powers of purchase are suspended shall be regulated. In lieu of acquiring any generating station and main transmission line in the district the Joint Authority may enter into agreements with the owners thereof for receiving a bulk supply from such owners or for the use of such generating station and main transmission line.

The following generating stations are to be utilised under the scheme and extended so as ultimately to form secondary capital stations:—Stepney (Stepney Borough Council); Bankside (City of London Co.); Deptford (London Electric Supply Corporation).

The following generating stations are to be utilised under the scheme and extended to a limited amount:—Battersea; Fulham; Hackney; Hammersmith; St. Marylebone; West Ham; Woolwich; Bow (Charing Cross, West End & City Co.); Grove Road (Central Electric Co.); Croydon; Guildford; Sevenoaks; Woking.

The following generating stations will be utilised under the scheme without further extension:—Barnes; Ilford; Islington; Poplar; St. Pancras (King's Road); Shoreditch; Walthamstow; Wimbledon; Gravesend; Wood Lane (Kensington and Knightsbridge Co. and Notting Hill Co.); Horseferry Road (Westminster Corporation); Blackwall Point (South Metropolitan Co.); Richmond Road (Brompton & Kensington Co.); Beckenham; Finchley; Hornsey; Kingston; Reigate; Twickenham; Uxbridge; Watford.

Thirty other generating stations will be utilised under the scheme until other supplies become available that will justify shutting them down, and to supplement the existing interconnecting and bulk-supply lines 18 transmission lines will be laid during the first stage of development. Further, provision is to be made in anticipation of the growth of demand for the erection in sections of new capital stations (as required) on sites to be approved by the Commissioners.

The developments within the area of supply of the North Metropolitan Electric Power Supply Co. will include the extension of the Brimsdown station so that it will constitute the principal generating station for the power company's area of supply; the shutting down of the power company's stations at Hertford and St. Albans when bulk supplies become available at rates justifying such a course; the interconnection of the power company's generating station at Willesden and the Willesden generating station of the Metropolitan Electric Supply Co., Ltd.; and the establishment of main transmission lines between:—Brimsdown—Hertford; Willesden—St. Albans; Hertford—Welwyn—St. Albans; St. Albans—Harpenden.

The developments within the bulk supply area of the Metropolitan Electric Supply Co., Ltd., will include the extension of the company's station at Willesden by the addition of three-phase 50-cycle generating plant; the above-mentioned interconnection and the establishment of three-phase transmission lines between:—Willesden—Ealing—Iron Bridge—Uxbridge; Iron Bridge—Heston—Twickenham. 26 generating stations owned by local authorities and 14 by companies as well as 12 transmission or interconnecting lines owned by local authorities and nine by companies are to be transferred or leased to the J.E.A.

If the Joint Authority makes default in the supply of electricity to any authorised undertaker, company, or person to whom it is required to supply electricity it shall be liable to a penalty not exceeding ten pounds for each day on which the default occurs.

LEGAL.

W. T. Kerr Sentenced.

The *Birmingham Post* reports that Walter Talbot Kerr, of Netherwood, Tupsley, formerly chief electrical engineer to Hereford Corporation, was at Hereford Assizes on Saturday sentenced to three years' penal servitude and ordered to pay the costs of the prosecution for fraudulent conversion and embezzlement of moneys while in the employ of the Corporation, the sum involved being £1,651.

The evidence showed that the prisoner in 1904 became chief electrical engineer to the Hereford Corporation, and remained in that position until March 25th last year. He commenced with a salary of £200 a year, but ultimately this was increased to £700 a year. He also received fees from pupils. He left because he obtained an appointment of a similar character in the Forest of Dean. When he had gone it was found that certain matters required explanation. Moneys had been received, and instead of their being handed over to the Corporation had been placed to his own private banking account. Every confidence had been reposed in him, and, said Mr. Vachell, he had taken advantage of this fact and robbed the Corporation systematically and thoroughly to a large extent.

Prisoner denied that there had been any fraudulent intention. He admitted he owed the money. It was a mistake in the accounts. He was not provided with petty cash, and for the purpose of his department he drew on his private account to the extent of perhaps £600 or £700 a year. Settlement by the Corporation was never made in less than five months, and this system had been in vogue since 1904.

Cross-examined by Mr. Vachell, Mr. Kerr said that when he left the Corporation a cheque for £79 was paid him in settlement of part of his claim upon it. He did not claim anything more. He had forgotten that he owed the Corporation £1,000.

The *Daily News* report states that Mr. J. B. Matthews, K.C., who appeared for the defence, said that the trouble could be traced to the system of allowing Kerr to trade on his own account, which inevitably led to a mix-up in the accounts. He had not the slightest intention of defrauding the Corporation, but through careless negligence had not refunded the money to the proper authorities.

The judge, summing up, said:

"If you find a man telling deliberate lies for the purpose of covering up fraud, how is it possible to say that his conduct can be explained by mere negligence and forgetfulness?"

The jury, without leaving the box, returned a verdict of "Guilty," and Mr. Justice Avory said that, had it not been for the fact that Kerr had tried to cover up his fault by evasions, he would have been dealt with leniently.

Tampering with Electric Cables.

In a case heard at Radcliffe Police Court, last week, it transpired that a Radcliffe youth's act had temporarily plunged the town of Rochdale into darkness and stopped the tramway service there for fifteen minutes. The Rochdale Corporation obtained a supply of electricity from the Lancashire Electric Power Co.'s works at Radcliffe, and the cables for this service pass through Chapelfield. It was alleged that a youth named Clifford Simpson had thrown a steel ring on to the cable, and so caused the trouble.

Mr. H. T. King, who prosecuted for the Power Co., explained that the cables in question had a voltage of ten thousand, and they provided the Rochdale Corporation with its supply of electricity from the works near Outwood. The ring created a short-circuit, and while some little damage was done to the plant, the chief trouble was that Rochdale was temporarily cut off from the source of supply.

The magistrates ordered the defendant to pay £2 to cover the damage done, and to pay the Court and legal expenses, £2 5s.

Charge Against a Theatre Manager.

A Scottish newspaper reports that in Stranraer Burgh Court, John E. Mitchell, manager, Empire Theatre, Queen Street, was charged with having on February 8th, in the engine room of the theatre (1) maliciously interfered with the shunt regulator and switchboard of the electric light system and increased the voltage, whereby the lights in the theatre suddenly flared up while the performance was in progress, and the lamp globes in the engine-room were destroyed; and (2) between 11 a.m. on the 8th inst., and 11 a.m. on the 9th, maliciously broken the engine governor, removed certain parts, and disconnected the wires from the switchboard. Accused was found guilty. Provost Dyer, in fining him £5 or twenty-one days, characterised the offence as a despicable and malicious one.

British Thomson-Houston Co., Ltd., v. Leicester Electrical Engineering Co., Ltd.

Mr. Justice Romer in the Chancery Division, on Friday last, had before him a motion by plaintiffs for an injunction restraining the alleged infringement by defendants of the plaintiffs' patent for leading-in wires for incandescent electric lamps.

Mr. Trevor Watson, for the plaintiff company, said the patent had been held to be valid by Mr. Justice Astbury in the Corona Lamp Works case. He read an affidavit by Mr. John Gray, the head of the plaintiff company's patent department, as to the purchase of the alleged infringing lamps.

Upon the application of counsel for the defendants, the motion was adjourned in order to consider the plaintiff company's evidence.

Ferguson v. Electric Components.

Mr. Justice Darling, in the King's Bench Division on February 9th, had before him an action brought by Mr. Richard Henry Ferguson, of London, against Electric Components, Birmingham.

Mr. C. W. Lilley, for Mr. Ferguson, said his client was an iron and steel merchant. His action was to recover £593, balance of price of goods sold and delivered by Mr. Ferguson to Electric Components, which was the name under which the defendant, Mr. Rippingille, carried on business in Birmingham. The goods were conduit tubing from Germany delivered at Birmingham and Manchester. Defendant alleged that there were certain overcharges for packing, and plaintiff's contention in regard to that was that the agreement provided for the charges made.

Mr. Alfred Barnes, manager of the plaintiff's tube department, gave evidence.

Mr. Rippingille, who conducted his own case, quoted a clause in the agreement between the parties, "packing for sea voyage extra," and asked witness if it were a custom in the conduit trade to deliver free packing in this country.

Mr. Barnes said it was a custom to deliver free package in England, because there was no sea voyage. But from Germany, whence the goods came, there was a sea voyage.

Mr. Justice Darling: Defendant says it is not a sea voyage from Germany to Birmingham, and Mr. Barnes says it is. That is the only point.

Mr. Rippingille: That is so. Proceeding, Mr. Rippingille said that packing for sea voyage referred to export orders, such as to New Zealand or Australia. His inference was that the goods would be delivered in this country packed, and that if he wanted to export them there would be an extra charge for packing, which was usual in the conduit trade. If the goods had to go to tropical countries, they would have to be packed otherwise than if they came through England.

Giving judgment, Mr. Justice Darling said the real dispute was whether or not plaintiff was entitled to charge defendant for packing the goods as though for a sea voyage. He had come to the conclusion that defendant was right. It was perfectly plain to both parties that the goods were to come from Germany. Most people did not make an extra charge for goods coming from Germany, but if the goods were brought to England and then went abroad across the Atlantic, there would be an extra charge. He would allow defendant £109 on the packing charge, which would reduce the claim to £484. Plaintiffs would have judgment on the claim for £484, with costs.

Fellows Magneto Co., Ltd., v. Mica & Micanite Supplies, Ltd.

The hearing of this action was finished by Mr. Justice Shearman in the King's Bench Division on February 9th.

Mr. R. A. Wright, K.C., and Mr. Samuels were for the plaintiffs, and Mr. C. T. Le Quesne for defendants.

Mr. Wright said the claim was for the return of certain moneys paid by plaintiffs to defendants for supplies of mica, or, in the alternative, for damages on the ground that the supplies of mica complained of were not in accordance with the contract. Defendants denied that there was any agreement to take back the mica which they had supplied to plaintiffs, and repay the money, and also denied that the mica was not in accordance with the contract. They also counterclaimed for damages for plaintiffs' not taking deliveries. Plaintiffs were large makers of magnetos for motor cars, and the mica sheets were for use in magneto construction. Orders were given to defendants by plaintiffs in February, 1920, and on following dates for large supplies. The goods rejected were examined to such an extent as to show, in the opinion of the plaintiffs, that they could be rejected as a whole. Defendants said it was too late to reject as plaintiffs claimed to do—the mica was supplied in 1921, and to that plaintiffs said they could reject because owing to the nature of their business they would not inspect the goods until they were wanted.

Plaintiffs alleged that the mica was defective owing to badly cut edges, thickness, bubbles and ripples, which defendants denied.

Considerable evidence was given on both sides, and his Lordship finally gave his decision without calling upon Mr. Le Quesne to address him for the defence.

Mr. Justice Shearman said that it was a mistake in the case of such a fragile article as mica to say, as plaintiffs did, that people need not examine it for a year after delivery. Plaintiffs had said it was regular practice, and that one could not be expected to find out whether the mica was up to the quality and fit for use unless it was required immediately for putting into work. On the other hand, he had evidence that one leading firm always examined within a month. If it were a regular practice to keep mica a year before examining it, that would be grossly hard on the supplier. His impression was that the mica supplied was a good average lot, and he was not satisfied that plaintiffs had suffered any grievance. He dismissed the claim with costs. On the counterclaim, plaintiffs said they did not refuse to take deliveries, but he was satisfied that they did refuse, and he gave defendants judgment on the counter-claim for £1,024 with costs.

Technology in the Rubber Industry.—The importance of the chemist and physicist to the rubber industry was emphasised in a paper bearing the above title, recently read by Mr. W. A. Williams (North British Rubber Co., Ltd.), at a meeting of the Institution of Rubber Industry. The investigatory side of a rubber manufacturing works required to be very comprehensive, and the author considered that the full organisation should be as follows:—Chemical and physical research and routine laboratories: mixings control; experimental; power, fuel, and boilers; and contracts and specifications laboratories: a specification and supplies link: and a work planning department. The functions of these were described in some detail, and the author also urged the importance of co-operative research among manufacturers.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Placing of Contracts by Public Bodies.

Considerable publicity has been given to the placing of contracts for electrical and other machinery with manufacturers at home in preference to firms abroad. The reasons advanced for so doing, are worthy of more careful consideration than would appear to have been bestowed upon the question by various authorities who have pronounced their views.

Among the advocates of the policy of preferential treatment are authorities who are as divergent in their constitution as one would expect them to be in their opinions; nevertheless, with one accord, they have advocated the adoption of a policy of expediency without regard, on the one hand, to the financial aspects of the case affecting the general body of the public as ratepayers who are called upon to furnish the necessary capital and to bear the contingent burden incidental thereto, and on the other, to the technical and engineering considerations involved which are vital to the maintenance of the dignity and status of the profession as a whole.

However, having regard to the differences in the constitution and interests of the publicists and the unanimous conclusions arrived at, whether from motives of self-interest or false notions of public duty or for any other reason, it behoves us in view of the unanimity of this opinion, to inquire into the matter carefully and dispassionately, casting aside the bias of political or such other motives necessitating the invocation of catch phrases, such as "patriotism" and the like, calculated to appeal to sentiment as against ordinary common sense.

What is the real position?

Our credit is high; very much higher in fact than that of any of the late belligerents, with the exception of the United States of America. This should be to our advantage, but coupled with it we have a very high percentage of unemployment, higher probably than other countries of consequence. As against this, the credit of Belgium, France, and Italy is exceedingly low, but the problem of unemployment is scarcely known in those countries, they are working hard and are fully employed. It would appear, therefore, that the question of credit or the position of the exchange and unemployment are, at the present time, co-related. To ignore this and place restrictions on the freedom of sale and barter tends rather to aggravate the situation, so far as it concerns ourselves, than to remedy it, for it stands to reason that the countries suffering from depreciated currencies are unable to purchase from us the things we make and of which they are in need, whilst at the same time, in regard to manufactured things which are common to ourselves and to them, they are able to enter our home markets and to undersell us. Such being the case and the fact that we are dependent for our existence upon our export trade in manufactured goods, the only sane policy would be for us to purchase our electrical machinery, which is accessory and incidental to our general manufactures, from abroad at lower prices than we are ourselves able to turn them out and thus conduce, on the one hand, to a reduction of an item of our overhead charges and consequently the cost of production, and on the other hand, help the recovery of the foreign exchange so that the foreigner might not only be able to buy our products but would also be in a much less favourable position to undersell us at home.

The policy of trading amongst ourselves at home is absolutely and totally wrong, being analogous to the serpent feeding upon its own tail. We cannot live but by exporting goods, and it therefore follows that we should avail ourselves of the depreciated exchanges to obtain at the lowest possible cost the accessories of our industries, enabling us to keep down our overhead charges represented by the capital value of the plant and the contingent annual charges, such as interest, depreciation, sinking and redemption funds. By so doing we help to reduce the cost of production, not only in the immediate present, but for years to come, and thus place ourselves in a position to tackle the world trade when values become stabilised and reach normality throughout the world.

If the foregoing proposition is sound it necessarily follows that to recommend an individual town in the country to overtax its costs of production and at the same time retard the recovery of the purchasing power of its customers abroad is antagonistic to its own interests and that of the country as a whole. It were far better that the town should exercise a little foresight, keep its capital and other charges low by taking advantage of depreciated currency abroad, and apply, if necessary, the difference in cost between British and foreign plant in more profitable local employment or, in the last resort, to the alleviation of its own distress.

A concrete example will better illustrate the foregoing argument without further elaboration, and, for this purpose, it is proposed to take the case of plant involving considerations of price and performance, say, a 200-kVA transformer, and

assuming that apart from differences in price and permissible tolerances, the British and foreign apparatus are in other respects equal.

200-kVA transformer.	British.	Foreign.
Guaranteed efficiency	98 %	98 %
Permissible tolerance	1¼ %	0.2 %
Capital cost	£260	£160
Annual charges:—	£	£
Interest and depreciation at 7½ % ...	18	12
Sinking fund, 15 years at 5 % ...	12	7
Iron loss, cost of energy, at ¼d. and 100 % L.F.	63	40
Copper loss, cost of energy at 1d. and 20 % L.F.	139	87
Capitalised: 15 years at 5 % ...	232=2420	146=1518
Present value	£2680	£1678
Difference in present value ...		£1002
	£2680	£2680

In such a case as the above it will be seen that the recommendation of the British plant is absolutely unjustifiable and next to impossible for an engineer discharging his duty faithfully, even for the sake (as pleaded by the President of the Federation of British Industries) of providing from 50 % to 80 % of the value of the plant in direct wages to some other part of the country. In cold print, the policy of the F.B.I. means that purchasers are to inflict upon themselves a penalty equivalent in present value to, say, £1,000 in order to provide approximately £85 in wages.

Summing up the situation, it is undoubtedly the best policy to allow trade to take its natural course, without legislative or sentimental restrictions, in the sure and certain belief of stabilising values generally and attaining a more rapid recovery for ourselves than would otherwise be the case; bearing in mind, in the meanwhile, that what is beneficial to an individual town is equally beneficial to the country, for it is as true to-day as it ever was that THE PART IS CONTAINED BY THE WHOLE.

C. W. Crosbie.

Bedford, *February 12th*, 1923.

The Carelessness of Power Users.

With reference to the recent correspondence under the above heading, there are other considerations than the efficiency of the motor. While not wishing to depreciate the importance of that point, the reason the motor efficiency is so prominent is because of the ease with which it can be measured. In the case of the internal-combustion or steam engine, where the efficiency cannot be so easily measured, the question is not so prominent.

The true problem that concerns the power user is what percentage of purchased energy he gets at the turning tool, circular saw, &c., as the case may be. A deplorable amount of unnecessary waste takes place after the electrical energy has been converted into mechanical energy.

The power user who can appreciate 2 per cent. better efficiency in the motor when the case is clearly stated to him, is often blind to the fact that by properly installing it, he could reduce the required electrical energy by 50 per cent.

Of the many points that require consideration, I venture to mention three only:—

(1) The motor manufacturer regularly gets requests to fit smaller pulleys than are capable of transmitting the full power developed by the motor. The power wasted by the pulley alone often varies from 5 per cent. to 20 per cent.

(2) Installing line shafting too small in diameter and using plain bearings instead of oil-ring or ball types. Here again 20 per cent. of the power may be saved.

(3) Belt drives are often too short and consequently excessively tight. This type of drive with the addition of some belt dressing varies the power user's loss more than he is capable of doing with the purchase of a motor.

When we consider that the maximum variation in the efficiency between various motors is in the neighbourhood of 5 to 7 per cent., and that a fair estimate of the power used at the turning tool, &c., is 10 to 20 per cent. of that supplied by the motor, surely the power user has food for thought in addition to motor efficiency.

Walter F. Higgs.

Birmingham, *February 12th*, 1923.

Arc Welding.

In extension of my letter published in your issue of January 29th, 1923, and in reply to Mr. W. Langdon Davies's letter of the 9th inst., I trust that before "This correspondence is now closed" appears, I may have a further short innings. Eliminating for the nonce the admitted poor power-factor consequent upon a.c. transformers or regulating devices, I submit that in "The welding arc" or any arc, there is something akin to a repulsive e.m.f., which borrowing from Mr. Davies I will term an e.m.f. of ionisation, which, for all I know to the contrary, may lag 90 degrees behind the impressed e.m.f. If Mr. Davies employs an ammeter, voltmeter and wattmeter across the arc electrodes only, I submit he will find a power factor extent of the order of 0.5 If he uses an oscillograph he will find the average current in a.c. amperes much less than that indicated by an ammeter even if the personal element of the individual welder be eliminated. Why? I think Mrs. Ayrton told us recently not to talk nonsense about back e.m.f.'s of arcs.

W. E. Rogers.

London, *February 11th*, 1923.

Static Charge in Printing Machinery.

I have noted with interest the remedies put forward for the presence of a static charge. Some weeks ago a correspondent experienced this static charge difficulty through rinsing silk in benzine. Three suggestions were put forward, including one of my own in which I advised the use of a number of discharge points obtained by the use of asbestos or mica wool. I think it would be very helpful to readers, if the correspondent in question would state the results obtained through the ELECTRICAL REVIEW.

W. Pinkerton.

Manchester, *February 12th*, 1923.

Earthing C.T.S. Cable.

Can any of your readers tell me how to earth the sheathing of c.t.s. cable? This is a question put to me by a local "Electrical Engineer."

Surely, for the public safety, this is a glaring instance showing the urgency of compulsory registration of electrical contractors.

J. Dean.

Aberystwyth, *February 9th*, 1923.

Radio Telephone Broadcasting Disabilities.

Regarding the note in your issue of the 9th inst. on broadcasting disabilities, it seems to me that the fault lies to some extent with the Post Office and the Broadcasting Co. themselves, in having insufficiently thought out beforehand the situation which would arise, although they must have known the extraordinary interest which had been aroused in America by the ability to broadcast music and speech to listeners over large areas.

Partly owing to domestic pressure, not unmixed with personal curiosity, as an old telephone worker, some weeks ago I determined to make inquiries as to purchasing a set. The firm to which I ultimately gave my order pointed out that I could get certain further facilities if I was in a position to obtain an experimental licence, which I thought my long connection with the electrical industry would fairly entitle me to, and I made application accordingly.

In the form that was given me to fill up, the question was asked whether I intended to use the apparatus for listening-in as well as experimenting, to which, naturally, I replied, yes. Indeed, it seems to me that it can hardly be supposed that anyone having the facilities will not listen-in.

I was informed that with an experimental licence the makers did not have to pay a royalty to the Post Office and Broadcasting Co., and from the form I filled up it is not clear whether the annual 10s. is payable or not.

Now, I have no desire, and I am sure it must be the same with others, to enjoy the broadcast concerts for nothing, nor do I see why apparatus which is capable of and may be used more or less frequently for listening-in, should contribute nothing, on at any rate a certain proportion of its capital cost towards maintaining the concerts at a high level, and providing promptly every technical improvement which may be made for their more effective transmission.

As an old telephonist, from what I have already seen we are, it is clear, in the presence of what can only be called an astonishing development, the consequences of which in its possible ramifications far outrun even the boldest imagination in several directions; this development it is clear to me from a conversation I have had with a leading Government expert, is out-running all previous calculations; adjustments will be required from time to time as they have been on perhaps a smaller scale in the electric lighting, power, and telephone cases.

One of the most extraordinary points is the interest these developments are exciting amongst the young. It seems to me that it is most desirable that this should be encouraged, as it would lead to a greater knowledge and appreciation of what electricity can do in other branches also, and help to educate men who in the future will be valuable in the industry.

It appears to me that the position which is arising is a complicated one, needing careful consideration, which in any case cannot be final, and that there is an important opening for prompt modifications in the present arrangements on broad and considerate lines which, while assuring revenue to permit the broadcasting to be of the highest possible character, will, on the other hand, avoid the discouragement of experimental ardour which it is a pleasure to see in so many of our young men.

In the meantime the public should have patience while

watching that any necessary rules for the general benefit place as little restriction as possible on the free development of this new industry which in the middle of an anxious and depressing time adds a new note of hope and interest for the future.

G. L. Addenbrooke.

Kensington, *February 9th*, 1923.

High-voltage Power Transformers.

May I be allowed, through your pages, to thank the Metropolitan-Vickers Electrical Co., Ltd., for the information given in answer to my request.

The writer—and no doubt every reader of your journal interested in this subject—feels thankful for the information recently contributed by the makers of high-voltage power transformers. It is to be regretted that other makers, actually manufacturing this grade of apparatus, did not respond. However, the actual state of high-voltage power transformer development is now more generally known to your readers.

As a result of the writer's investigation it may now be put on record that several British makers (thanks to the good working experience gained in the last few years with h.p. power transformers) have designed and built and now have in successful operation power transformers on 110,000-V circuits; that quite a number of makers are actually building, have already built, or have on order, power transformers to operate at line voltages not much under 100,000 V; and it can be taken that these manufacturers are in a sufficiently satisfactory position to design, build, and to guarantee their respective products for 110,000-V circuits. Therefore, no doubt should now be left in the minds of engineers and others (with particular reference to the Colonies, India, &c.,), that British manufacturers can supply them with necessary requirements, such as live insulators, transformers, &c., for 110,000 V or even 132,000 V; in fact, in the writer's opinion, it may with safety by taken that, for voltages of this order, difficulties and uncertainties in the matter of design, manufacture, and assembly, &c., are things of the past.

The experience gained in the last few years with 110,000-V transformers shows that the principles of design of the now more common type of big power transformer, *i.e.*, the upright core type, have been along sound lines. It is the type that gives the simplest mounting of the windings and the best advantages in the event of repairs, &c. Moreover, the old idea that the core type transformer is more liable to damage by short-circuits has been entirely removed. Of interest is the fact that British manufacturers are concentrating their attention on the manufacture of this type.

It has perhaps been noticed that the writer omits any mention of "extra-high-voltage" transformers. The reason is not far to seek, since the expression and its meaning are condemned if not changed in accordance with operating voltage changes. Many years ago 6,000 V could be considered and perhaps classed as "e.h.t.," but when we confuse this voltage with a voltage about twenty times greater, and call both "e.h.t.," then there is reason for a radical change in definitions.

William T. Taylor.

London. *February 9th*, 1923.

A Motor-starting Problem.

The only reliable remedy, under conditions stipulated by Mr. Smith, is to arrange the *starters* with double-pole control, so as to open both leads to the motor independently of the local d.p. switch. Face-plate starters of this type are common on many of the older types of mining coal-cutters; two plain segmental plates are fitted diametrically opposite the step contacts, and the movable arm is extended so as to carry a contact brush mounted on suitable insulation, which bridges the above segments, when the starter arm is raised to the first step; these plates and brush open the main usually run direct.

Glasgow, *February 12th*, 1923. **Clyde.**

In reply to Mr. Smith's inquiry in your last issue, his problem is fully taken into account in the design of our Vauxhall pillars.

These pillars embody a contactor in each pole, and the contactors can only be closed by the operation of the starting handle, and then only if the whole of the starting resistance is in circuit. The motor is therefore completely isolated, and no circuit through the motor is possible until the starting handle is manipulated.

As a further protection, an overload release is provided in each pole, so that if an earth should occur while the motor is running, the contactors will be tripped.

We shall be pleased to send a diagram of connections if the above explanation is not clear.

The Electrical Apparatus Co., Ltd.

London, *February 12th*, 1923. S. Amberton, *Director*.

[A description of the Vauxhall pillar, which we have had in preparation for some time, appears on p. 277 of this issue.—Eds. Elec. Rev.]

Whilst I am not able to offer a solution to your correspondent's problem, perhaps the following observations may be of some little interest. It is understood, of course, that "earthing" the metal framework of electrical apparatus is done principally to prevent shock, should any "live" conductor accidentally come in contact with the framework. Mr. E. Smith points out another danger with "earthed" starters, namely, the danger of a man having a limb cut off with a circular saw. Suppose the control gear could be made immune from faults, there would still be the danger of faults developing in the motor, or, in fact, any part of the circuit. Although anxious to help your correspondent, I think he will realise from the foregoing the difficult nature of his problem. The writer has connected many hundreds of starters and motors, but has never "earthed" starter cases unless compelled to do so, and the supply company in this city does not insist on this rule. In Mr. Smith's case, it seems to be, of two evils choose the least, namely, risk a slight shock and prevent a man's hand being cut off. Whilst on the subject of "earthing," I have been compelled on a few occasions to "earth" the cases of ironclad fuses on a three-wire d.c. system, with the result that when a fuse burst, a complete new fuse-box had to be fitted, whereas if no "earth" wire had existed, a piece of fuse-wire would have served the purpose, and much time and trouble would have been saved. I have no desire to criticise rules laid down for the protection of human life, but one or two rules exist of which the usefulness is just a little doubtful, and I would say I have never heard of anyone receiving a fatal shock from the case of a starter for a d.c. motor.

Contractor's Foreman.

Glasgow, *February 10th*, 1923.

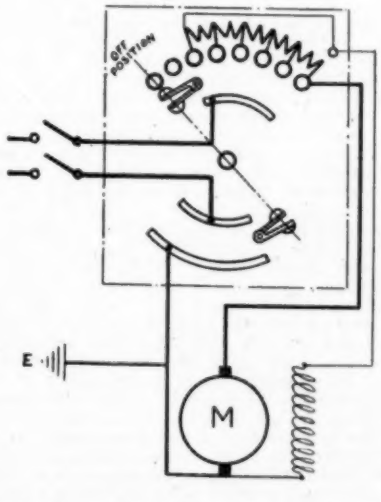
Mr. Smith's trouble is fairly common on three-wire systems. This unfortunately cannot be corrected. But I think an interlocked switch and starter would be quite safe, because the operator when desiring the motor to start would close the local switch, and should the motor start a little sooner (about 5 seconds at the most) than he expected, he can open the switch again and notify the electricians and have the starter attended to. I have had about four years' experience of three-wire systems and have never known the slightest accident to occur through an earthed starter.

Should Mr. Smith not agree with me he could install a belt-drive with an idle pulley on the saw shaft, thus doubly protecting the operator.

W. Skipsey,
Electrician.

Durham, *February 11th*, 1923.

In your issue of February 9th, Mr. Smith described some trouble experienced owing to motors on a d.c. three-wire system starting when the main switch is closed and before the starter has been operated. This, of course, is due to the fact that an ordinary d.c. starter only opens the circuit in one place, so that if there is an earth on the motor, wiring, or starter, current can flow to it through the motor from the side of the line not broken by the starter.



Our d.p. "Navy Type" starters were specially designed to give protection against this possibility, as they open both sides of the line, and the accompanying diagram of connections makes this clear. For the sake of clarity the no-voltage and overload releases and the blow-out are not shown, but these do not affect the point at issue.

Bray, Markham & Reiss, Ltd.
R. H. Barbour, *Director*.

London, *February 12th*, 1923.

In reply to the letters of "Peekay" and Mr. Fletcher, while I have had similar trouble, traced to the same source as "Peekay" stated, I don't think it was the case with the machine under notice. As for the suggestion put forth by Mr. Fletcher, regarding the field brush seating, while I admit that a large increase or decrease in current can be obtained by only moving the field brush the smallest trifle, I am sure that this was not the cause of the trouble, as I had the machine run up to 2,000 revs. on a testing stand, while off the car, and tried the brush in every position, but I could not get full output.

The brush itself was of the thin type described by Mr. Fletcher, and was just a good working fit without any "wobble" whatever, besides having been "bedded down" to the commutator with fine sandpaper; all connections were tightened up. The machine was of the single-pole type *i.e.*, earthed to the frame of the car. I forgot to remark before that, when the machine was refitted to the car (and started to charge immediately afterwards) the field circuit fuse blew, but afterwards I experienced no further trouble in that respect.

G. F. Hardwick.

February 11th, 1923.

Secret Commissions.

I was much interested in Mr. Theodore Rich's article on "Secret Commissions and Corruption," but I think he is unduly despondent when he says that for all practical purposes the Prevention of Corruption Act has remained a dead letter. To the end of last year (there have been several cases since) convictions had been secured in respect of 532 offences under the Act; and I shall be pleased to send last year's record of cases, together with other printed matter about the League and its work, to any of your readers.

It is undoubtedly true that "powerful influences can be brought tending to protect the wrongdoer"—that is true of all crimes; but I can assert that nothing would influence the League against instituting proceedings if it were furnished with evidence that would hold good in a Court of Law, and if—an important if—the Law Officers of the Crown did not withhold the fiat.

The Secretary,

Bribery and Secret Commissions Prevention League, Incorporated.

London, *February 8th*, 1923.

BUSINESS NOTES.

Bankruptcy Proceedings.—Fuller Heath & Co. (Edward Fuller Ernest Heath), electrical engineers, 26, Buckingham Gate, S.W.—The debtor again attended on February 6th, and was further questioned by the Official Receiver. The examination was then concluded.

Reginald James White, electrical agent, Golden House, 29, Great Pulteney Street, London, W.—The public examination of this debtor was held on Tuesday last week before Mr. Registrar Mellor at the London Bankruptcy Court, the accounts showing liabilities £1,195 against assets valued at £99. Replying to Mr. Armstrong, Official Receiver, the debtor said he commenced business at the above address in October, 1920, in partnership with one G. H. B. Dent, paying that gentleman £200 premium and investing £300 in the business. They traded as Dent & White until March, 1921, when Mr. Dent retired from the partnership. Witness was then joined by another partner, who paid a premium of £50 and invested £500 in the business, which was continued at the same address under the style of White & Dayrell; that partner resigned in May, 1922, and paid £100 as his share of the partnership deficiency at that time. Witness thereupon took an employé into partnership and continued the business as White & Co. He attributed his insolvency to depreciation in the value of his investments in house property at Potters Bar. The examination was concluded.

Harry South, 43, Rathbone Place, Oxford Street, and late of 10-12, Garrick Street, Covent Garden, London, electrical engineer.—An application for an Order of discharge was made to Mr. Registrar Mellor at the London Bankruptcy Court, on Tuesday by this bankrupt, who failed in April, 1903. Mr. Armstrong, Official Receiver, reported that the ranking liabilities amounted to £1,413, and nothing had been realised from the estate. The bankrupt commenced business as an electrical engineer in 1884, and in December, 1899, he transferred the concern to "Harry South & Co., Ltd.," with a nominal capital of £10,000, which was formed to take it over. The consideration was £4,000, payable half in cash and half in shares of the company, of which he acted as a managing director, at a salary of £5 a week until it went into liquidation in December, 1901. He attributed his failure and insolvency mainly to depreciation in the value of the shares of "Harry South & Co., Ltd.," and to his liability for costs in an action in reference to the proposed purchase of a music hall. It further appeared that between January and June, 1902, the bankrupt lost £176 by Stock Exchange speculation. The offences reported were: (1) insufficiency of assets to equal 10s. in the £ on the amount of the liabilities; (2) contributing to the bankruptcy by rash and hazardous speculations. His Honour granted a discharge, subject to a judgment for £5, to be satisfied by an immediate cash payment.

John Kaine-Fish, "Sempolia," West Green Road, Tottenham, London, N., late Etherley Road, wireless instrument maker.—The first meeting of the creditors of the above was held on February 6th at 26, Russell Square, London, W.C.1. It appeared that the receiving order was made on January 11th last on debtor's own petition. The case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

L. Seddon (The Electrical Engineering Co.), electrical engineer, 18, Westwood Road, and 276a, Buxton Road, Stockport.—Receiving order made February 6th on debtor's own petition.

G. J. Hogg (F. Hogg & Co.), electrical engineer, 66, Waterloo Road, Smethwick.—Last day for proofs for dividend February 26th. Trustee, Mr. T. Easton, Official Receiver, Ruskin Chambers, 191, Corporation Street, Birmingham.

Edward Mitton, Queen's Hall Buildings, Church, electrical and automobile engineer.—Examination was closed at Blackburn Bankruptcy Court on February 7th.

C. J. Cox (C. J. Cox & Co.), electrical and automobile engineer, Pontefract Road, Castleford, Yorks.—Receiving order made February 6th on debtor's own petition. First meeting February 20th, at the Official Receiver's Office, 21, King Street, Wakefield; public examination, March 8th.

W. Hill, seedsman and electrician, 3, Leigh Road, Leigh, Lancs. Trustee, Mr. J. Grant, Official Receiver, Byrom Street, Manchester, released February 8th.

H. S. Rogers, electrical engineer's sales manager, 21, Derby Street, Walsall.—First and final dividend of 3s. 11d. in the £ payable February 20th, at the Official Receiver's office, 30, Lichfield Street, Wolverhampton.

Company Liquidations.—Corona Lamp Works, Ltd., 10, Ascham Street, Kentish Town, London, N.W.—As briefly stated last week, the statutory first meetings of the creditors and shareholders were held on February 6th at the Board of Trade Offices, Carey Street, W.C., before Mr. E. T. A. Phillips, Official Receiver. A statement of affairs was presented showing the company's position on May 15th, 1922, when a receiver was appointed on behalf of the debenture holders. The accounts showed total liabilities £110,655, assets valued at £27,251, but absorbed in the claims of the debenture holders; and a deficiency of £84,265 as regarded contributories.

The chairman reported that the company was registered as a private company on June 28th, 1911, and was formed to acquire the business of manufacturers of electric lamps carried on by Mr. Geo. N. Ogilvie under the style of the Corona Lamp Works at Southfields and Kentish Town. The nominal capital was £2,000, divided into £1 shares. The directors were Mr. Geo. N. Ogilvie, Mr. A. N. C. Macklin (resigned August, 1913), Mr. W. H. Collins, and Mr. H. G. Romer. The remuneration of the directors was fixed at £200 per annum each, with an additional £50 per annum to the managing director; no remuneration had been paid to the directors as such, but Mr. Collins had acted as secretary and general manager of the company at a salary of £1,150 per annum. The company entered into an agreement with one Stephen Horvath, manufacturer of electric lamps, to purchase a business carried on by him at Southfields, with all assets and liabilities, for £5,000, payable by instalments extending over seven years. In addition, Mr. Ogilvie agreed to register within eight months a company to acquire the business, with a nominal capital of not less than £100,000 and to obtain the allotment or transfer to Mr. Horvath of 9,000 fully-paid shares of £1 each. Mr. Ogilvie then obtained additional premises at Kentish Town, and carried on business until July, 1911, when he entered into an agreement under which the businesses, together with all the assets, were transferred to the company for a purchase consideration of £2,000 in shares and an undertaking by the company to pay all debts and liabilities, and to take over all contracts and engagements of the vendor relating to the business. The latter provision appeared to include the transfer to the company of Mr. Ogilvie's liability to pay £3,800 to Mr. Horvath to form a company with a capital of £100,000 and to arrange for the transfer or allotment to Mr. Horvath of £9,000 shares. On March 8th, 1912, Mr. Horvath entered into an agreement with Mr. Ogilvie and the company under which he agreed to accept payment of the £3,800 by instalments. Subsequently, for a consideration of £305, he released the company and Mr. Ogilvie from any further performance of the agreement of April 13th, 1911. The company's business had been chiefly that of manufacturers, importers, and dealers in electric lamps. In order

to carry out the several processes necessary for producing the finished article, factories were set up at Kentish Town, Highgate, and Wimbledon. Shortly after the outbreak of war the company found it necessary to manufacture glass, and established glass works at Round Oak, Staffs.; they took a lease of an old glass factory on onerous terms, with the result that they were now liable under a judgment for £1,591 in respect of dilapidations.

As the company's trade increased, it became necessary to establish branches for the sale of its goods, and subsidiary companies were formed as follows:—Balfour Baring, Ltd.; The Kingsway Manufacturing Co., Ltd.; Corona Lamp Works (Northern), Ltd.; Corona Lamp Works (Ireland), Ltd., subsequently changed to The Royal Sovereign Lamp Works, Ltd.; and Corona Lamp Works (Southern), Ltd.

Shortly after the outbreak of war Mr. Geo. N. Ogilvie acquired from his brother, Mr. Alexander Ogilvie, the patent rights relating to the manufacture of an aeroplane speedometer invented by the latter. The Aeronautical Instrument Co., Ltd., was registered, and Corona Lamp Works, Ltd., acquired all its shares for £20,250 in cash. The company was financed throughout by Mr. Ogilvie and his relatives, the total amount advanced by them exceeding £60,000, and, in addition, Mr. Ogilvie guaranteed the company's bank overdraft of £3,000. Debenture bonds were issued at various times between July, 1911, and March, 1919, and at the date of the receiver's appointment bonds for £44,250 were outstanding, the whole number being held by Mr. Ogilvie and his relatives.

The company at various times had been concerned in actions in respect of infringements of patents relating to the manufacture of electric lamps. One action against the company, relating to the manufacture of metal filament lamps, which was commenced in 1914, was compromised by the payment of £1,000. Subsequently an action relating to drawn-wire lamps was commenced against the company, in which the patent was declared by the House of Lords to be invalid, and was subsequently revoked at the instance of the company. On March 24th, 1917, an action for infringement of patents relating to the manufacture of gas-filled lamps was commenced against the company. After successfully defending this action in the High Court and the Court of Appeal, both of which declared the patents to be invalid, the owners of the patents appealed to the House of Lords, which, on December 19th, 1921, reversed the decision of the Courts below. Another action for infringement of the patent relating to leading-in wires of electric lamps was commenced against the company, and in this action, which was concluded in March, 1922, the company was unsuccessful. As a result of the final appeal in the action of the gas-filled lamps, the company was ordered to pay the plaintiffs' costs of the action and of the two appeals, and also to repay, with interest, £5,529 paid by the plaintiffs to the company in respect of the costs of the action and the first appeal. As the company failed to make this repayment, execution was levied on its goods in May, 1922. The debentures thereupon immediately became payable, and on May 15th, 1922, Mr. V. G. Teale, C.A., was appointed receiver and manager of the company's property and assets, of which he was still in possession.

The company's trading was carried on at a heavy loss; it had been insolvent for years past, and but for the financial support of Mr. Ogilvie and his relatives its activities would have ceased long since. The failure was attributed by Mr. Ogilvie to the adverse decision of the House of Lords, the effect of which had been to limit the company's productions to one class of goods, loss on trading, and also to diminished sales and depreciation in the value of stock, owing to general trade depression.

It was decided to leave the liquidation in the hands of the Official Receiver.

Anode Wireless and Scientific Instruments, Ltd., London.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors in this matter took place at the Cannon Street Hotel, E.C., on February 9th, when the liquidator, Mr. E. S. Howard, presided. Mr. Howard stated that he was appointed liquidator by the shareholders of the company on January 19th, and he had had no connection with the company prior to that date. The company was formed on October 20th, 1922, but it was actually registered on October 6th, 1922. The vendors were a company called Anode Co., Ltd., and the sale agreement contained provision that they were to receive £800 in cash and 5,500 shares, but they had only received £200 of the £800. The chairman said that there was a letter dated October 20th whereby the Anode Co. agreed to have the balance of £600 out of the future takings of the Anode Wireless & Scientific Instruments, Ltd., as and when convenient for the company to pay them. He (the chairman) would like to add that the directors were Mr. Minvalla, who resigned his position on December 31st last, Mr. Peak, who was connected with the Anode Co., Mr. Lunnis, Mr. Gray, who was the sales manager, and Mr. Rayner, who was the technical director. The company took premises at St. Pancras, agreeing to pay a rent of £1,150 per annum, with rates in addition. A lease had been drawn up, but it was not signed, and the landlord issued a writ against the directors for specific performance, and was claiming six months' rent.

Mr. Baker, representing St. Helens Cable Co., asked if the secretary of the company had sent out a notice calling the shareholders together, but he was told that this was not done.

Before going on to the statement of affairs, Mr. Howard said that the sales of the company had approximated about £500. The books of the company were not kept very well. With regard to the business, the company had made certain wireless sets, some of which had passed the Post Office official test, and they had four other sets which were practically ready for submission to the Post Office. Some of the sets were not perfect, and the company was in consequence getting some of them back.

The paid up capital of the company was £1,823 in cash. The capital issued was £6,423, and there should have been another £900 issued to the vendors. The registered capital of the company was £30,000.

With regard to the liabilities, there was due to unsecured creditors £1,691, while the Anode Co. as vendors were claiming £52. The assets consisted of cash in hand and at bank £12, stock £397, estimated to produce £350, and sundry debtors £225, making total assets £586, from which had to be deducted £160 for preferential claims, leaving net assets £426, or a deficiency of £1,317. With reference to the stock, Mr. Howard went on to say that there were some sets uncompleted, and these were considered to be of no value, but, on the other hand, if some money was spent on them they might possibly be worth about £200. There were also some sets which were faulty, but it was thought that they might be rectified for about £10 and probably then be worth £100. Mr. Howard said that it must be borne in mind that the company had paid no broadcasting fees, and had not paid any Marconi Royalties.

Mr. Houstoun, representing the General Electric Co., asked whether there was a contract whereby the directors agreed to take 500 £1 shares. Mr. Minvalla, in reply, said that all the directors agreed to take was their qualification shares.

Mr. Houstoun: Who is the contract between? The Chairman: I have no particulars here with me.

Mr. Houstoun said that he thought that there was only one thing for the creditors to do in this matter, and he was instructed to move a resolution on behalf of the company he represented that a petition for the compulsory winding-up of the company be presented as soon as possible.

Mr. Idris said that he quite agreed with the last speaker, as he thought the affair should be thoroughly sifted out, and he had much pleasure in seconding Mr. Houstoun's proposal.

A resolution was then put to the meeting that application be made at once to the court for the compulsory winding-up of the company, and this resolution was carried unanimously.

British Transmission Co., Ltd.—Winding up voluntarily. Liquidator: Mr. F. G. Price, 73, Basinghall Street, E.C. Meeting of creditors, February 22nd. Particulars of claims to the liquidator by March 22nd.

Electro-Metallurgical Extraction Co., Ltd.—Particulars of claims to be sent to the liquidator, Mr. J. A. Charlton, Bank of England Chambers, Tib Street, Manchester, by March 25th.

Connolly Bros., Ltd.—"New first meeting" of creditors and contributors, February 21st, at Carey Street, W.C. The liquidator, Mr. J. M. Henderson, who was appointed in 1919, having died, it is proposed to consider the appointment of a successor.

E. B. C. Electrical Co., Ltd.—Meeting of creditors, February 20th, at the office of the liquidator, Mr. F. Rowland, 3, Thames House, Queen Street Place, E.C., to whom particulars of claims should be sent forthwith.

Abbott, Anderson & Abbott.—Particulars of claims to be sent by February 26th to the joint liquidators, Mr. E. C. Moore, Thames House, Queen Street Place, E.C., or to Mr. H. Sharp, 16, King Street, E.C.

Meeting of Creditors.—F. J. Yates, electrical contractor (trading as F. J. Yates & Co.), 72, High Street, Leicester.—A meeting of creditors was to be held on Tuesday last at Leicester. Several creditors had sued, so debtor executed a deed of assignment in the interests of the general body of creditors. Communications to Messrs. Miles, Rowley & Co., chartered accountants, 20, Friar Lane, Leicester.

Dissolutions of Partnership.—Richards, Elston & Thomas, electrical engineers, 52a, Bow Lane, E.C.—Messrs. A. S. Richards, G. L. Elston, and J. S. Thomas have dissolved partnership. Debts will be attended to by Mr. Elston and Mr. Thomas, who will continue the business under the style of Elston and Thomas.

Home Radio Service, wireless telephony specialists, 35 and 36, Sicilian House, Sicilian Avenue, W.C.1.—Mr. L. Weinberg and Mr. G. Maynard have dissolved partnership. Debts will be attended to by Mr. Maynard, who will continue the business.

Trade Announcements.—Rotax (Motor Accessories), Ltd., state that their Liverpool agent, Mr. P. Wright, has removed to 28, Union Marine Buildings, 11, Dale Street, Liverpool. Mr. J. Ardrey is not now their agent for the Northern Counties of Ireland, and Messrs. Warren, Johnston & Co., 57, Upper Arthur Street, Belfast, are acting in that capacity.

Messrs. A. C. Alexandra & Co., 10, Iddesleigh House, Caxton Street, London, S.W., have been appointed sole representatives for London and the Southern Area for The Burnley Components, Ltd., a number of whose illustrated lists are before us showing and pricing the "Burco" electric fans and electric fires. They supply component parts of all kinds in bulk quantities.

The Imperial Engineering Co., of Wolverhampton, has appointed Messrs. Higgin, Ltd., of 265, Deansgate, Manchester, as its agent for the sale of heating appliances in the Northern Counties, North Wales, Cornwall and Devon.

The Visco Engineering Co., Ltd., has appointed a number of additional representatives for the following districts:—Birmingham: Mr. Norman A. Lane; South Midlands: Mr. L. M. Russell Cox, Rugby; Hull: Mr. Wm. Wilde; South Wales: Mr. Alex. C. Scott, Cardiff.

Mr. G. R. Martin, of 22, Summerhouse Cottages, Vicarage Farm Road, Hounslow, who is about to commence business, asks for copies of electrical wholesalers' catalogues.

Messrs. L. P. R. Bean & Co., Ltd., of 229-231, Castlereagh Street, Sydney, New South Wales, are in the market for supplies of domestic electrical apparatus, such as irons, toasters, cooking stoves, &c., and general electric light accessories. Mr. Bean is now in this country.

Mr. A. Hinderlich, of Central Hall, Southall, Middlesex, has moved into new premises at Lechmere Road, London, N.W.2., where he holds various electrical stocks.

The A-C Cutting & Welding Co., Ltd., has removed to 24, Bedford Row, London, W.C.1.

Catalogues and Lists.—The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet No. S. 2887, illustrating and describing the "Flash-o-Lite" flashing adaptor; Technical Description No. 235, dealing with draw-out oil-immersed flame-proof switchgear; and Technical Description No. 253, giving illustrated details of a.c. motor control gear.

Northern Electric Manufacturing Co., 42, Cable Street, Rochdale Road, Manchester.—An illustrated folder advertising the "Winter" switch-plug. Priced.

The Aster Engineering Co. (1913), Ltd., Wembley, Middlesex.—A folder containing a number of illustrations in colour of "Aster" engines and generating sets.

The "Eureka" Cutter-Welder Tool Co., Ltd., Temple Iron Works, Temple Street, Manchester.—A pamphlet illustrating and describing the "Eureka" patent apparatus for cutting, welding, soldering, or annealing, using oxygen and oil fuels.

Messrs. Siebe, Gorman & Co., Ltd., 187, Westminster Bridge Road, London, S.E.1.—Folder giving some particulars and prices of their lead hydrate batteries for car lighting, starting and ignition, also for radio purposes.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—Replacement sheets for general catalogue dealing with electric bath-water heaters, wash boilers, water urns, kettles, hotplates, cookers, &c.

The British Electric Transformer Co., Ltd., "Tricity" showrooms, 50, Oxford Street, W.1.—A supplementary catalogue of heating, cooking, and other electrical appliances. Fully priced.

Messrs. Cleworth, Wheal & Co., Ltd., Grange Engineering Works, Castleton, near Manchester.—A reprint from the *Westminster Gazette*, describing the firm's air filter.

Messrs. Todman, Ryall & Co., Ltd., 38, Grosvenor Gardens, S.W.1.—A catalogue containing illustrated description of "L.W." and "E.A.O." motors and dynamos, transformers, &c.

Carron Company, 15, Upper Thames Street, E.C.4.—An illustrated and priced folder advertising electric heating and cooking appliances, arranged for overprinting with a contractor's name and address.

Messrs. Chubb & Son's Lock & Safe Co., Ltd., 128, Queen Victoria Street, E.C.4.—An artistically illustrated brochure dealing with the history and products of the firm.

The Cressall Manufacturing Co., 40 and 41, Staniforth Street, Birmingham.—An illustrated and priced leaflet describing "Cressall" laboratory electrically-heated water baths.

Hopkinson Induction Motors, Seagrave Road, West Brompton, S.W.6.—A folder giving particulars of one-, two-, and three-phase motors and starters. Fully priced.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publication No. 343, a list of reduced prices in connection with the twelfth edition catalogue.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A folder advocating the use of the company's system.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Descriptive Leaflet, No. 59/5-1, giving illustrated details of auto-transformer and star-delta starters for two- and three-phase squirrel cage motors. Also a well-produced catalogue (Special Publication, 7445/2), containing numerous illustrations and full descriptions of Metropolitan-Vickers "Rateau-Impulse" type steam turbines; and a reprint from the *Electrician* on "High-Voltage Switchgear Design" (Circular No. 1287/1) illustrating and describing electrolytic lightning arresters.

Westinghouse Electric & Manufacturing Co., East Pittsburgh (Pa.), U.S.A.—Two illustrated pamphlets, dealing respectively with electrical equipment for mine fans and electrical equipment for "larry" cars. Also a series of illustrated pamphlets dealing with automatic sectionalising contactors for railway and mining service, exciter and voltage regulator panels, thermal demand meters, and watt-hour meters.

The Scarborough Engineering Co., Ltd., Willow Hall Works, Burnley Road, Halifax.—An illustrated pamphlet describing the "Scarborough" internal-combustion engine pumping set.

Cryselco, Ltd., Kempston Works, Bedford.—A coloured showcard (21 in. x 15½ in.) advertising "Cryselco" gasfilled lamps.

The Electric Construction Co., Ltd., Ingersoll House, 9, Kingsway, W.C.2.—A booklet (B 505) describing multi-speed induction motors (Creedy Patents) of small and medium sizes. Also an illustrated leaflet showing a speed controller for a "Creedy" six-speed motor.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—February stock list of a.c. motors, and d.c. dynamos and motors.

Broadcasting in Cardiff.—The radio-telephone broadcasting station in Cardiff having commenced operation on the 13th inst., Messrs. Siemens Bros. & Co., Ltd., have made arrangements to demonstrate their broadcasting receiving apparatus at their branch office in St. Mary Street, Cardiff (telephone No. 1960). Electrical dealers in South Wales are cordially invited to make an appointment by communicating with the company's branch office.

Book Notices.—"Fifty Years of 'Via Eastern'" is the title of a sumptuous volume which we have received from the Eastern Associated Telegraph Companies—a souvenir of the celebrations in connection with the jubilee of the companies, which were held at the Royal Botanic Gardens, on July 24th last year. The frontispiece is an admirable portrait of Sir John Denison-Pender, G.B.E., K.C.M.G., chairman of the associated companies, and a large number of portraits of other directors, as well as of members of the staff, are given. A foreword briefly sketches the history of the "electrified ropes with which man has encircled the earth," recalling the names of Lord Kelvin, Sir James Anderson, and Sir John Pender, who played so great a part in the establishment of the great Eastern group, which now owns 130,000 miles of submarine cable, two-fifths of the world's total, worth some 25 millions sterling. The companies have laid 28,000 miles of cable since the Armistice was signed. Illustrations are given of the beautiful volume, containing the signatures of 8,000 members of the staffs, which was presented to Sir John Denison-Pender on July 8th, together with reproductions in platinum, set with brilliants, of the insignia of his Orders; and a portrait of the late Lady Denison-Pender, to whose memory the staffs dedicated and endowed a bed at St. Bartholomew's Hospital, on July 20th. The remainder of the volume is devoted to a detailed and fully illustrated record of the Jubilee celebrations, the speeches delivered at the banquet, the list of guests at the banquet and fête, and the numerous telegrams and Press comments by which the occasion was signalised. The whole forms a unique and worthy record of a unique occasion, upon which the companies are to be congratulated.

Faraday House Journal.—The Lent issue of this house organ contains, in addition to the usual notes and notices of interest to Faradians, an article by Mr. T. R. Warren, on "The Insulation Resistance of three-phase Networks," and an account of the products and works of Messrs. A. Reyrolle & Co., Ltd.

The Brown Boveri Review, December, 1922. London: Brown, Boveri & Co., Ltd.—Included in this issue are illustrated articles on: "The Synchronisation of Synchronous Motors on Load"; "Disturbances in Electrical Plants Due to Lightning"; and notes on the official trials of electric locomotives for the Swiss Federal Railways, &c.

The *Journal* of the Junior Institution of Engineers, February, 1923. London: Percival Marshall & Co. Price 2s.—The principal paper reproduced in this issue is that on "Transient Phenomena Arising in Transformers from Switching Operations," by S. Austen Stigant, A.M.I.E.E. The main heads of the paper are: Switching-in current rushes; switching-in pressure rises; and switching-out pressure rises. Dr. C. C. Garrard's address to the Midland Section entitled "Economics in Engineering," is included, and notes of visits, &c., also appear.

The Queen's Engineering Works Magazine, January, 1923 (100 pp.). Bedford: W. H. Allen, Sons & Co., Ltd.—Mr. Richard Allen, C.B.E., contributes a review of events during the past year. Other articles deal with mechanical transport at the works of the company; a South African tour; "Allen" heavy fuel oil engines and Diesel engines; the Derwent Valley Water Board; the "Allen" steam turbine, &c.

The *Journal* of the South African Institution of Engineers, January, 1923. Johannesburg: The Institution. Price 2s.—The principal papers reproduced in this issue are:—"Economy in 'Massed' Repairs," by W. C. John, A.M.I.Mech.E., and "Developments in Machinery for Fluting Grooved Rolls," by H. W. Miller and L. Praeg. There is also an illustrated description, by the inventor, Mr. E. J. Way, of a device for eliminating the re-winding of kinematograph film.

"Dictionary of Allied Physics," by Sir Richard Glazebrook, F.R.S. Vol. I—Mechanics—Engineering—Heat. Pp. ix+1,067. Illustrated. London: Macmillan & Co., Ltd. Price 63s. net.

Copper and Lead Prices.—Messrs. F. Smith & Co. report February 13th:—Copper electrolytic bars, £73, 10s. increase; do. do. sheets, no change; do. do. wire rods, £83, 10s. increase; do. do. h.c. wire, 10 5-16, 1-16d. increase.

Messrs. James & Shakespeare report February 14th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £29 10s., 5s. increase.

Our Foreign Trade.—January Figures.—The following were the values of imports and exports of electrical goods and machinery during January, 1923:—

	Jan. 1923.	Inc. or dec.
Imports.—	£	£
Electrical goods and apparatus	173,126	+ 61,416
Machinery	821,386	+298,990
Exports.—		
Electrical goods and apparatus	761,188	− 41,021
Machinery	5,229,738	−570,386
Re-exports.—		
Electrical goods and apparatus	14,259	+ 2,094
Machinery	97,169	+ 28,702

Electric Stoves for Johannesburg.—The Durban Town Council has authorised the borough electrical engineer to obtain full particulars which will enable him to place a scheme before it of hiring out electric stoves to consumers of electricity. There are now 11,000 customers connected to the mains and heating devices are very freely used, the price of energy after the consumption of a certain minimum being ½d. per kWh.

Manufacturers are therefore invited to send full particulars of their manufactures to the Borough Electrical Engineer's Office, Durban, South Africa. Approximate prices of stoves in lots of 100, packed and delivered c.i.f. Durban, Natal, would be useful.

The Business Efficiency Exhibition.—The above exhibition, organised by the Office Appliance Trades Association, was opened by the Postmaster-General (Mr. Neville Chamberlain) on February 9th. The show consists of numerous appliances and systems for reducing work and speeding up business in offices, and while only large firms could afford to acquire the majority of the facilities offered, smaller firms are also catered for. There are numerous card-index systems, makes of typewriters, addressing machines, postage registers, &c. Among the calculating machines exhibited, several are driven by electric motors, performing their duties in an almost uncanny manner; among these are the "Madas" and "Millionaire" calculators shown by Messrs. Gilbert Wood, and machines shown by the Monroe Calculating Machine Co., Ltd., and the Accounting and Tabulating Corporation of Great Britain, Ltd. The British Tabulating Machine Co., Ltd., demonstrates electrical sorting and tabulating machines. Dictograph Telephones, Ltd., exhibits examples of its intercommunication systems for large and small works or yards. One of these permits three or four people to hold a conference without leaving their respective offices, and loud-speaking devices are also fitted to a number of the instruments. In addition to these, the company shows a loud speaker for use in a radio-telephone receiving set. The Telephone Manufacturing Co., Ltd., is also showing telephone equipment of many patterns. There are small wall 'phones, laryngophones, and intercommunication sets. This firm also has a display of radio-telephony receiving apparatus, including an elaborate 5-valve set mounted in an oak cabinet with a loud speaker incorporated in the body. One feature is a two-stage amplifier for employment with a crystal detector. There is also a small 3-valve set in which a loud speaker is incorporated, and combined crystal and valve sets.

Trade Union Amalgamation.—At a conference held in Manchester on February 6th, representatives of twenty-nine engineering and metal workers' trade unions passed a resolution favouring the formation of one large union to embody the whole. Among the unions represented were the Amalgamated Engineering Union, the Electrical Trade Union, and the National Union of Foundry Workers; the membership of the unions concerned is about 800,000. It is suggested that a joint committee of the unions be appointed to investigate the possibilities of amalgamation, this committee to report to a further conference.

New German Company.—An international electrical concern was launched at Zittau on January 9th by the creation of the Vereinigen Elektricitäts Gesellschaft. Its field of action is East Germany and the eastern border States of Lithuania, Latvia, Esthonia, &c. The new firm embraces a number of important German factories specialising in dynamos, motors, apparatus, meters, and accessories, and the Czecho-Slovakian Elektro-industrie Gesellschaft, Reichenberg, Bohemia, which is taking a strong financial and economic share in the venture. The seat of the new company is Königsberg.

Applications for British Trade Marks.—The following are included among the recent applications for British trade marks. Objections have to be lodged within one month from the dates given:—

Elmo. No. 430,031. Class 50. Electric insulating substances and electric insulators.—The Siemens-Schuckertwerke Gesellschaft, Siemensstadt, near Berlin. (Haseltine, Lake and Co., 28, Southampton Buildings, Chancery Lane, London, W.C.) February 7th, 1923.

Scout. No. 430,207. Class 8. Dry cells and batteries, not for medical purposes.—Falk, Stadelmann & Co., Ltd., 85-87, Farringdon Road, London, E.C. February 7th, 1923.

Chakophone. No. 431,502. Class 8. Apparatus for use in wireless telegraphy and telephony.—Champ, Kay & Co., 95, Saltisford, Warwick. February 7th, 1923.

For Sale.—By instructions from the liquidator of the Wareham Electric Supply Co., Ltd. (in voluntary liquidation), Messrs. T. Ensor & Son will sell by auction on March 1st, at Wareham, electrical plant, machinery, equipment, and together with the power house buildings, &c. Edinburgh Corporation electricity department has several d.c. generating sets for disposal. (See this issue.)

Trading With Russia.—Yesterday afternoon, under the auspices of the Russian section of the London Chamber of Commerce, an address was delivered by Mr. Jonas Lied, F.R.G.S., entitled "The Kara Sea Trade Route to Siberia and the Possibility of Trading with Russia." Mr. Jonas Lied has recently returned from Moscow.

An Irish Outrage.—The premises of Mr. Sean McGarry, a Dublin electrical contractor and a member of the Irish Free State Parliament, were blown up by "Irregulars" last week. A valuable stock of fittings was totally destroyed. Shortly before this outrage, Mr. McGarry's private residence was burned down—one of his children being killed.

Patent Application.—Application has been made for the restoration of Patent No. 137,311, of 1916, granted to L. C. Connelly and W. C. Connelly for "Improvements in water-tube steam generators."

Unemployment.—The "Live Registers" of the Unemployment Exchanges showed a total of 1,409,900 wholly unemployed persons on January 29th, 28,941 fewer than in the preceding week. Workers on short time numbered 54,700, comparing with 54,000 on January 22nd.

A Big American Truck Contract.—The Philadelphia Rapid Transit Co. has given an order to the J. G. Brill Company for 586 Brill cars, complete with Brill trucks; the value of the contract is $6,500,000.

New French Company. — With the title Syndicat National des Industries Radio-Electriques, a new association of concerns interested in the sale and manufacture of wireless apparatus in France has just been formed, with headquarters at 6, Rue Daubigny, Paris.

E.D.A. Activities.—The British Electrical Development Association has published a pamphlet bearing the title "A Check on Business and How to Avoid it" (E.D.A. 344), in which the necessity for standard plugs and sockets is emphasised. The Association calls attention to the British Standard Specification dealing with this matter, and illustrates the unnecessary trouble caused at present by stating that the 5-A two-pin plug is made in no fewer than 30 different patterns and sizes.

LIGHTING AND POWER NOTES.

Ashford (Kent).—Electricity Supply.—The Canterbury City Council has offered to give a supply of electricity in bulk to the Urban Council based upon an ultimate maximum demand of 500 kW. The cable is to be the property of the Corporation, and Ashford is to pay a minimum yearly sum equal to the annual cost of repayment and interest upon the capital expended (£2,456); a sum of £2 10s. per kW of maximum demand for the use of the generating plant at the Canterbury station, 1½ per cent. of the capital cost, estimated at £162, for maintenance of mains, &c., and, in addition, a sum of 1¼d. per kWh for all electricity delivered at Ashford.

Bamford.—Electricity Supply.—The Parish Council has agreed to allow the Rochdale Corporation to lay mains for the purpose of supplying current to the mills of Messrs. Porritt and Sons, Ltd.

The borough electrical engineer of Rochdale has been requested to supply the Council with particulars of the cost of supplying electricity for street lighting.

Barrow-in-Furness.—Extensions.—The Town Council has decided to make extensions to the electricity works at a cost of from £6,000 to £7,000.

Bradford.—Loan.—The Electricity Committee has approved a scheme for laying a new feeder from Thornbury sub-station to Dudley Hill, at an estimated cost of £9,881, and application is to be made to the Electricity Commissioners for borrowing powers.

Loan Sanctioned.—Sanction has been received from the Commissioners to the borrowing of £19,200 in connection with the acquisition of land for extensions to the electricity undertaking.

Electricity Extensions.—The Electricity Committee has secured approval, subject to borrowing powers being obtained, to laying new feeders, at an estimated cost of £37,218, as follows: two e.h.p. feeders from Bolton Road sub-station to Barmby Road, £7,850; two e.h.p. feeders from Valley Road station to Thornbury sub-station, £24,150; one l.p. general supply feeder from Bolton Road sub-station to Garnett Street; and one traction supply l.p. feeder from Bolton Road sub-station to Harris Street, £5,218.

Colne.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £10,000 for mains, services and transformers.

Continental.—France.—A scheme to reorganise the electrification of the department of Calvados as a whole has been put forward by M. Vasseur, engineer-in-chief of the department. He proposes the erection of a 30,000-V circular distribution line around the department, to which will be linked existing and new lines and stations, and from which will branch secondary lines to feed the communes and rural districts. The circular line will be 130 km. in length; it will cost nearly 1,500,000 fr., and it will take three years to complete. The department's budget for 1923 includes already a first credit of 200,000 fr. in connection with this scheme.

The Société de Transport d'Energie des Alpes has applied for a State concession to set up a large distribution network between its hydroelectric stations and certain areas situated in the departments of the Ain, Isère, Loire, Rhône, Savoy and Upper Savoy.

A concession to supply seven districts with electricity for general purposes in the departments of the Basses-Pyrénées and Landes has been applied for by the Société des Forces Motrices de la Vallée d'Aspe.

Spain.—The Co-operativa de Flúido Electrico of Barcelona is preparing plans for supplying electricity in the Barcelona region. The company intends to utilise the falls on the River Cadi and coal from its own mines.

The Unión Eléctrica Madrilena is about to increase its plant in order to comply with the State's requirements. The Unión will take a large share in the Eléctrica de Castilla, which anticipates producing 40,000,000 kWh yearly when it has completed its hydro-electric works, &c., on the River Jucar.

It is announced on the Bourse that several Asturian coal companies have formed a group with a capital of 4,550,000 pesetas, of which 3,100,000 is contributed by the Duro-Felguera concern for generating electricity by utilising coal of inferior quality, the sale of which is very difficult. The initial output of the scheme will be 5,100 kW, to be supplied by the Duro-Felguera company.—*Reuter's Trade Service* (Madrid).

Darlington.—Price Reductions.—The Electricity Committee has recommended that the charge for electricity for lighting be reduced from 7½d. to 6½d. per kWh.

Doncaster.—Price Reductions.—The Electricity and Tramways Committee has recommended the Town Council to reduce the charges for electricity for lighting from 7d. to 6½d. per kWh, and for cooking from 2½d. to 2d. per kWh.

Dover.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £40,000 for additonal plant at the electricity works.

Gillingham (Kent).—Electricity Scheme.—The Town Council has appointed a committee to consider the question of erecting a new power station and the installation of steam turbine generators, or to install another Diesel engine, or to take an additional supply of electricity when required from the Gillingham Portland Cement Co. The committee is also to go into the question of the whole administration of the Electricity Department.

Harrogate.—Year's Working.—The total revenue of the electricity undertaking (engineer: Mr. G. Wilkinson) for the year ended March 25th, 1922, was £44,742, as compared with £39,169 in the previous year. Working expenses amounted to £29,228, as against £26,578, leaving a gross profit of £15,514 (£12,591). The net result was a profit of £4,049, which, similarly to a balance of £3,949 in 1921-22, was used to defray capital expenditure. A total of 2,547,288 kWh was sold, as compared with 2,358,956 kWh in the preceding year. The amount spent on capital account during the year was £41,618, of which machinery accounted for £36,130.

Horley (Surrey).—Electricity Order.—Five directors of the Horley District Gas Co. have applied to the Electricity Commissioners for an Order to enable them to supply electricity to Horley and the surrounding districts. The site of the proposed generating station is in Balcombe Road, Horley.

Huntingdon.—Electricity Supply.—The Town Council has decided to support an application by clients of Sir Charles Bright & Partners, Ltd., for an Electricity Order subject to a draft of the scheme being submitted to the Council.

Kingston-on-Thames. — Price Reductions. — The Town Council has further reduced the charges for electricity for lighting from 8d. to 7½d. per kWh, and for power, heating and cooking to a flat rate of 2½d. per kWh.

Kirkcaldy.—New Plant.—The Electricity Committee has considered the report submitted by Messrs. Kennedy and Donkin, consulting engineers, on extensions to the electricity undertaking, and has recommended the Council to proceed with Part 2 of the scheme. The new plant proposed is as follows:—A second 3,000-kW turbo-alternator, with condensing plant, &c., £18,657; super-heaters for four boilers, £2,800; switchgear for second alternator and extension feeders, together with cables in the power house, £1,000; a new cooling tower, with tank, £5,070; stokers for two boilers, £3,000; portable coal conveying gear, £340; stokers for three boilers, £4,500; storeroom and workshop building and removing machine tools, £1,000; h.p. feeder extensions, £8,000; l.p. feeder extensions, £2,000; engineering contingencies, £4,636; a total cost of £51,000. The cost of the whole scheme, including Part 1, which is now being carried out, is £81,000.

Long Eaton.—Year's Working.—The accounts of the municipal electricity undertaking (engineer: Mr. F. Newey) for the year ended March 31st last, show a total revenue of £18,190, and working expenses amounting to £13,938, leaving a gross profit of £4,252. As capital charges absorbed £4,339, the net result was a loss of £87. The amount of energy sold rose from 992,443 to 1,008,702 kWh.

Manchester.—Price Reductions.—The Electricity Committee has decided to reduce the charges for electricity for lighting by ¼d. per kWh and by 10 per cent. for hired motors.

Redcar.—Electricity Supply.—The Town Council has appointed an electric lighting committee to consider the question of electricity for the town, and to prepare a report.

Redditch.—Transfer of Undertaking.—Subject to the consent of the Electricity Commissioners, the Urban Council has decided to transfer its electricity undertaking to the Shropshire, Worcestershire and Staffordshire Electric Power Co., Ltd., as from April 1st next. The capital sum involved is estimated at about £109,000, and in addition the company agrees to pay an amount not exceeding £5,000 towards any deficiency in the current financial year.

St. Helens.—Price Reductions.—The Electricity Committee has reduced the charges to ordinary consumers for lighting, power and heating from 60 to 50 per cent. above pre-war charges. For outside shop signs and outside shop lighting the charge is to be 2d. per kWh, plus 50 per cent.

Sandwich.—Proposed Electricity Supply.—Sir Charles Bright & Partners have asked the Town Council whether it would support an application to the Electricity Commissioners for power to supply electricity in the borough. The Council has requested further particulars of the scheme.

Stockport.—Extension of Supply.—The Town Council has completed arrangements for supplying electricity to the Hazel Grove and Bramhall Urban Council. The Macclesfield Electricity Co. has asked the Corporation whether it is prepared to supply it with electricity in bulk.

Stockton-on-Tees.—Extension of Supply.—The Corporation has approved of a scheme for laying new cables at an estimated cost of £17,206, and application is to be made to the Electricity Commissioners for sanction to borrow that amount.

Walton-le-Dale.—Electricity Order.—The Urban Council has decided to apply for powers to enable it to supply electricity in the urban area. It is proposed to obtain a bulk supply from Preston Corporation.

Wardle.—Electricity Supply.—The Urban District Council has appointed a sub-committee to interview the borough electrical engineer of Rochdale with a view to obtaining a supply of electricity for lighting purposes.

West Africa.—Gold Coast.—A scheme is in hand for supplying the town of Accra with electricity. The estimated cost of carrying out the work is £60,000. Sir William Arrol and Co., Ltd., are the contractors. The Governor has promised to hand over the management of the undertaking to the municipal authorities when it is completed.

West Hartlepool.—Price Reductions.—The Town Council is making the following reductions in the charges for electricity: Lighting (flat rate), from 7½d. to 6½d. per kWh for the first 1,500 kWh; power, from 3½d. to 3¼d. per kWh for the first 50 kWh; the next 450 kWh from 2½d. to 2¼d. The rate per kWh in excess of this amount will be reduced to 1¾d.

Weymouth.—New Plant.—The Council has instructed the electrical engineer to prepare plans and specifications, and invite tenders for additional plant for the electricity works. The approximate cost will be £10,000.

Windsor.—Price Reduction.—The Electrical Installation Co., Ltd., has reduced the charge for electricity for lighting by 1d. per kWh.

Wrexham.—Electricity Supply.—The North Wales Power Co. has submitted an offer to the Town Council for giving a bulk supply of electricity. The company's terms are 8s. 4d. per kWh of maximum demand per month, plus ¾d. per kWh, with a discount of 5 per cent. on all supplies in excess of the first 1,000,000 kWh. The Electricity Committee has recommended that the company's offer be accepted, with the substitution of 0.66d. per kWh for ¾d. The estimated cost of carrying out the scheme is £17,000.

TRAMWAY AND RAILWAY NOTES.

Continental.—France.—The city of Lyons is experimenting with accumulator electric omnibuses, independently of the Compagnie des Omnibus et Tramways de Lyons. If satisfactory results are obtained, a concession will be granted to the applicant, who is prepared to establish a service embracing the main roads of the city and suburbs. The city will undertake to supply the water, gas, and electricity needed for the scheme.

Spain.—A company has been formed, styled the Tranvia Electrico de Pontevedra, at Pontevedra, to construct an elec-

tric tramway between Levez, Pontevedra, and Marin, with sundry branches. The capital will be 2,000,000 pesetas in 50-peseta shares.

A concession has been granted to the Sociedad Tranvias de Sevilla to construct an electric tramway from Triana (Seville) to San Juan de Aznalfarache y Gelves.

Hungary.—The high cost and scarcity of imported coal, accentuated since the conclusion of the war, has forced forward the question of the electrification of the railways. Steps are now being considered to this end, and it is proposed to take in hand eleven of the principal lines, a total length of 1,385 km. Power stations will be built close to the chief brown coal and turf fields, and here only such fuel as is unsuitable for other industrial purposes is to be used for generating electricity. Electrification, it is anticipated, will effect a saving of 60 per cent. of the coal formerly used, and allow the country to supply its requirements from its own resources.

Czecho-Slovakia. — *Railway Electrification.* — It is announced that some of the local lines converging on Prague are to be electrified.—*Reuter's Trade Service* (Prague).

Dover.—Reduced Fares.—The Town Council is reducing the 1½d. fare stages to 1d.

South Africa.—Johannesburg.—In connection with the proposed electrification of the central and suburban railway lines of the Witwatersrand and Pretoria districts, the Town Council has passed a resolution approving of the scheme and the extension of existing lines, and asking the Mayor to convene a meeting of representatives of the municipalities, chambers of commerce, and agricultural societies of Pretoria and Johannesburg to support the representations referred to in the recommendation.

South Shields.—Proposed Tyne Tunnel.—The Corporation is promoting a scheme to connect North and South Shields by means of a tunnel under the Tyne. It is proposed to lay a tramway track through the tunnel. The chief object of the scheme is to provide work for the unemployed.

St. Helens.—Loan Sanctioned.—The Corporation has received sanction from the Ministry of Transport to a loan of £4,000 for hardening the rails on the St. Helens Junction section of the tramways.

TELEGRAPH & TELEPHONE NOTES.

Belgian Congo.—Telegraph Service.—Telegraphic communication has been established between the Kilo region of the Belgian Congo and the British telegraph system in Uganda.—*The Times.*

Czecho-Slovakia. — Telephone Service. — Last year the Czechoslovak postal authorities completed the construction of 87 new inter-urban telephone lines and 71 local systems, besides carrying out the reconstruction of 14 of the latter. For this year the construction of 39 further inter-urban lines is projected, including an international connection between Prague and Paris.—*Reuter's Trade Service* (Prague).

France.—Telephone Extensions.—A scheme has been drawn up by the Postes, Téléphones, et Télégraphes Department, in conjunction with the Conseil Général of Morbilion, for the extension of the telephone network in the department named. The work is to be carried out in three sections, at an outlay of 502,920, 251,600, and 281,630 fr. respectively, as speedily as material and labour are available.

Radio-Telegraphy.—A scheme whereby Stock Exchange, produce markets, and fish-market prices are to be daily circulated to the ports and other places interested by radio-telegraphy is being elaborated by the Under Secretary of State for the Merchant Marine and the Post Office. The scheme will involve no State outlay, the cost to be covered by the fees exacted, and its special object is more particularly the furnishing to the fishing ports of early morning intimation of the ruling quotations in the Paris markets.

Greece.—Telephone Development.—It is the intention of the Greek Ministry of Posts and Telegraphs to equip the country with an up-to-date system of telephones. To this end offers are now being invited for a concession or concessions, for periods of years, to construct and work, as a first step, installations at Athens, at the port of Piræus, and at Salonica. The exchanges may be of any modern system, automatic or half automatic. Later on, offers will be entertained for telephone installations in other cities of Greece containing a population of over 100,000. The length of the concessions, which will not be for less than 30 or more than 50 years, will be arranged by agreement. Those desirous of further information should make application to the Ministère des Postes, Télégraphes et Téléphones at Athens.

New Atlantic Cable.—The Western Union Telegraph Co. opened its new direct London to Boston cable on February 8th. Of the total length of the line, 3,435 miles, 2,435 miles is submarine cable between Penrance, in Cornwall, and Heart's Content, in Newfoundland.

Pacific Earthquake.—Cable Interruption.—On February 4th the Hawaiian Islands were swept by tidal waves when a violent earthquake shook the ocean floor somewhere in the South Pacific. Fragmentary reports show that the Midway-Guam cable was broken, and efforts to reach Samoa by wireless have been fruitless. Honolulu escaped severe damage.—*Daily Mail.*

Radio-Telephony.—Broadcasting.—A conference took place at the General Post Office on February 12th between representatives of the Postmaster-General's Department and the British Broadcasting Co. on the present position of broadcasting. An exchange of views took place, it is understood, on the revenue outlook of the company. For several reasons, it is explained, the position of the company is not satisfactory. The evasion of the regulations by listeners-in who fail to secure a Post Office licence or who purchase unauthorised apparatus was also discussed.—*The Times.*

The fifth radio-telephone station commenced operations on behalf of the British Broadcasting Co., Ltd., at Cardiff on February 13th with the call signal 5 W A.

Licences.—In November, 1922, 3,000 licences for the use of listening sets were issued, and in December 6,000; when the January, 1923, figures are available, it is believed they will show a total for the three months of 25,000. At the same time, the number of applications for experimental licences in December, 1922, was 3,500, and in January, 1923, they were received at the rate of 6,500 per week; in the last week of that month they rose to 11,000. It is calculated that about 60,000 receiving sets are now licensed in this country.—*Daily Mail.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review in which the "Official Notice" appeared.)

OPEN.

Annfield Plain.—February 17th. Electric lighting installation at Dipton branch of the Annfield Plain Co-operative Society, Ltd. Mr. G. T. Wilson, architect, 23, Durham Road, Blackhill, Co. Durham.

Argentina.—Buenos Aires.—April 26th. Department of Sanitary Works. Nineteen groups of vertical centrifugal pumps, with electric motors and spare parts.

A copy of the specification is expected to reach the Department of Overseas Trade about the end of the present month.

Australia.—Sydney, N.S.W.—February 26th. Department of Public Works. Two electrically-driven stiff-leg derrick cranes for the Cordeau Dam.*

Hobart (Tas.).—April 9th. Postmaster-General's Department. Telegraph and telephone material.

Adelaide.—April 18th. Postmaster-General's Department. Telephone apparatus.*

Melbourne.—Postmaster-General's Department. 16,750 Leclanché porous cells and 1,200 earthenware outer jars.*

February 22nd. Switchboard parts. March 1st. Telephone and telegraph parts. March 16th. Telephone and switchboard parts and wires. March 21st. Testing and protective apparatus. April 9th. Telegraph and telephone material. April 10th. Bronze and copper wire. April 11th. Positive plates for storage batteries. April 17th. Covered wires. April 18th. Telephone apparatus. April 24th. Telephones and handsets and switchboard cable. (See this issue.)

March 28th. Victorian Railway Commissioners. Two sets of 3-ph., 20 b.h.p. induction motors, starting apparatus, and accessories; one 20-b.h.p. d.c.-motor, starting apparatus and accessories.*

April 3rd. Postmaster-General's Department. 5,100 telephone-receiver diaphragms.*

April 10th. 686 tons bronze wire, &c.*

April 17th. 400,000 copper jointing sleeves, 595 timing clocks.*

April 4th. Victorian Government Railways. Electric hoist, with trolley.*

Barking.—March 12th. County of London Electric Supply Co., Ltd. Condensing plant and auxiliary apparatus for the Barking power station. (February 9th.)

March 26th. Static transformers. (February 9th.)

Belfast.—February 19th. Electricity Department. H.p. 3-phase, 6-core, split-conductor cables. (February 2nd.)

March 10th. Stores (including many electrical items) for six or twelve months. (See this issue.)

March 12th. 3-ph., h.p., a.c. switchgear for sub-station. (See this issue.)

March 6th. Tramways Committee. Six or 12 months' supply of tramways stores, including several electrical items. (See this issue.)

Belgium.—February 21st. Belgian Office de l'Electricité, 25 Rue de la Charité, Brussels. 25,000 metres of insulated copper wire.

Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels. Installation of a second local telephone exchange at Antwerp. Date for receipt of tenders altered from March 14th to April 18th.

February 19th. Provincial Government authorities at Hasselt. Establishment of an electricity supply system in the town of Rothem.

Birmingham.—March 5th. Education Committee. Motor generators, transformers, and switchgear, for the Municipal Technical School. (February 9th.)

China.—TIENTSIN.—March 12th. Peking-Mukden Railway. Electric signalling material. Specification from Mr. C. P. Sandberg, 40, Grosvenor Gardens, S.W.

Darlington.—March 7th. Electricity Department. One water-tube boiler. (See this issue.)

Dewsbury.—February 21st. Town Council. Pumps and motors for the sewage disposal works. February 28th. Sewage screens, with electrically-driven raking and cleaning apparatus. James Diggle & Son, consulting engineers, 14, Brown Street, Manchester, or Mr. H. Dearden, borough engineer, Dewsbury.

Doncaster. — February 17th. Housing Committee. Wiring installation for electric lighting in 126 houses on Carr House Road site. Mr. R. E. Ford, housing surveyor, 3, Priory Place, Doncaster.

Douglas (Isle of Man).—February 19th. Town Council. Electric wiring and fittings at the markets. Borough surveyor.

Eastbourne.—Electricity Department. One 200-V single-phase, motor-driven, centrifugal boiler-feed pump. (February 2nd.)

Edinburgh.—February 19th. Corporation. Works in connection with extension of switch house at M'Donald Road power station. City architect.

Egypt.—CAIRO.—March 22nd. Egyptian State Railways. Water-tube boiler, h.p. cables, switchboard panel and transformers for the electric power house, Gabbary. Specifications from Stores Department, Saptia (Cairo), or Gabbary (Alexandria), and at the office of the Administration's Inspecting Engineer in London, Major J. S. Liddell.—*Reuter's Trade Service* (Cairo).

Director, Section of the Municipalities and Local Commissions, Savoy House, Cairo. Extension of the electric system at Zagazig.—*Reuter's Trade Service* (Cairo).

Elland.—February 20th. Urban District Council. Electrical work required in connection with the alterations and additions to the sewage works. Mr. W. R. Nunns, 2, Albert Road, Saltaire, Bradford.

London.—LONDON COUNTY COUNCIL.—February 19th. L.p. electric cables, overhead electrical equipment. (February 2nd.)

STEPNEY. — March 1st. Electricity Supply Committee. River-water screening apparatus. (February 2nd.)

ST. MARYLEBONE.—February 28th. Electricity Department. Suction and discharge pipework and valves, h.p. steam pipework and valves, ash-handling equipment, electrically-operated jib crane or transporter equipment, e.h.p. and l.p. switchgear, annual supplies of underground cables. (February 9th.)

FULHAM.—February 28th. Electricity Department. Twelve months' supply electrical and engineering stores. Particulars from the Town Hall.

Londonderry.—February 28th. Electricity Department. Two water-tube boilers, with superheaters, economisers, stokers, steam and feed piping, coal elevators, &c. (February 2nd.)

Manchester. — February 27th. Tramways Committee. Tramway stores. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—WELLINGTON.—March 20th. P. W. Department. 400 miles h.d. copper wire.*

Portsmouth.—March 6th. Town Council. Electrically-operated jib crane. Mr. A. Ward, borough engineer.

Salford.—Tramways Committee. Special track work. General manager, Tramway Offices, 32, Blackfriars Street, Salford.

South Africa.—JOHANNESBURG.—March 5th. South African Railways and Harbours Board. Electrical cables and bare copper wire.*

PRETORIA.—March 14th. Government Posts and Telegraph Department. Insulators, copper and braided wire, &c.*

Stoke-on-Trent.—March 7th. Electricity Department. Step switch resistance. (See this issue.)

Torquay. — February 26th. Electricity Department. Four 3-ph. to 2-ph. transformer groups. (February 9th.)

Tottenham.—February 20th. District Council. One electrically-driven capstan, complete. Engineer to the Council, Town Hall.

Tynemouth.—February 28th. Electricity Department. Switchboards for sub-station; transformers. (February 2nd.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Blackpool.—Tramways and Electricity Committee. Recommended:—

Three petrol-electric 30-passenger, 40-h.p. motor-'bus chassis (£1,015).—Tilling-Stevens, Ltd.

The Town Council has referred the matter to the General Purposes Committee.

Bolton.—The Cleansing and Sewage Committee has accepted the tender of the Bolton Corporation Electric Fittings Department for installing electric light at Back-o'-th'-Bank, Wellington Yard, and Falcon Yard.

Bradford.—Electricity Committee.

Cast-steel replacement parts for Curtis turbines.—British Thomson-Houston Co., Ltd.

Erection of chimneys (including platform and stairs) to cooling stacks, Valley Road works.—Davenport Engineering Co.

Canada.—WINNIPEG.—The Municipal Council of Winnipeg has accepted Messrs. Jas. Howden & Co.'s tender of £50,000 for turbine plant.

Doncaster.—Tramways Committee.

Doubling of track from Balby Bridge in a south-westerly direction, and widening of roadway (£1,292).—G. Percy Trentham, Ltd.

Gillingham (Kent).—Town Council. Accepted:—

Fuel oil for the electricity works for a year, at £4 12s. 6d. per ton.—British Petroleum Co.

Japan.—THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., has recently received an order from the Nippon Denryoku Kabushiki Kaisha, Amagasaki, near Osaka, Kobe, for two 25,000-kW, 11,000-volt, three-phase, 60 period, turbo-generating sets, running at 1,800 r.p.m. The turbines will be of the multiple exhaust design and arranged for two-stage feed heating, and the generators will be provided with the firm's closed circuit ventilation system. The order also includes one 1,000-kW, 3,300-volt, three-phase, 60 period, house-service turbo-generating set, operating at 3,600 r.p.m. We understand that this is the first occasion on which this Japanese concern has gone outside America for its plant.

Ramsbottom.—Urban District Council.

Reconditioning of cars, Nos. 1-4 (including new chassis), and conversion to one-man operation; new chassis for car No. 6 and petrol omnibus.—Railless, Ltd. (Accepted.)

Ships' Telegraph Installation.—Messrs. A. Robinson and Co., Ltd., have secured the contract for the supply and fitting of the whole of the telegraph installation of the two new battleships, one vessel being fitted at Birkenhead and the other at Wallsend-on-Tyne. The outfit comprises engine, stokehold, and closed exhaust telegraphs, mechanical tell-tales, revolution telegraphs, electrical steering telegraphs, direction and revolution indicators, &c.

Stockton-on-Tees.—Corporation. Accepted:—

Electric cables (£7,396).—British Insulated & Helsby Cables, Ltd.

FORTHCOMING EVENTS.

National Association of Supervising Electricians.—Saturday, February 17th. At the Holborn Restaurant, W.C. At 6.30 p.m. Annual dinner and musical evening.

Royal Institution of Great Britain.—Saturdays, February 17th and 24th. At 21, Albemarle Street, W. At 3 p.m. Lectures on "Atomic Projectiles and their Properties," by Sir Ernest Rutherford, F.R.S.

Northampton Engineering College Engineering Society.—Monday, February 19th. At the College, St. John Street, E.C. At 5.30 p.m. Lecture on "The Construction of the Atom," by Mr. H. Buckley.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, February 19th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Esprit de Corps," to be opened by Mr. F. Peake Sexton.

EXTRA MEETING.—Thursday, February 22nd. At the Institution. At 6 p.m. Lecture on "Transoceanic Wireless Telephony," by Dr. W. H. Nichols.

(North-Western Centre).—Tuesday, February 20th. At the Engineers' Club. At 7 p.m. Paper on "Maintenance of Voltage on a d.c. Distribution System by Means of a Fully Automatic Sub-station," by Mr. P. J. Robinson.

Friday, February 23rd. At the Midland Hotel, Manchester. At 7 p.m. Annual dinner.

(Sheffield Sub-Centre).—Wednesday, February 21st. At Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper on "Cement Manufacture and the Application of Electric Drive Thereto," by Mr. W. J. Coles.

(Liverpool Sub-Centre).—Monday, February 19th. At the University, Liverpool. At 6.45 p.m. Special meeting, re formation of Centre. At 7 p.m. Ordinary meeting.

(East Midland Sub-Centre).—Tuesday, February 20th. At the Loughborough College. At 6.45 p.m. Short papers on "Electrical Motors and their Applications."

(North Midland Centre).—Tuesday, February 20th. At the Metropole, King Street, Leeds. At 7 p.m. Paper on "Some Problems in High-speed Alternators and their Solution," by Mr. J. Rosen.

(South Midland Centre).—Wednesday, February 21st. At the University, Birmingham. At 7 p.m. Ordinary meeting.

British Industries Fair.—At the White City, Shepherd's Bush, W., and Castle Bromwich Aerodrome, Birmingham. February 19th to March 2nd.

Illuminating Engineering Society.—Tuesday, February 20th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "The Projection of Light," to be opened by Mr. W. I. Jones and Mr. E. A. Marx, Junr.

Paisley Association of Engineers.—Tuesday, February 20th. At 99, High Street. At 7.30 p.m. Paper on "Economic Production of Steam," by Mr. C. S. Grieff.

Liverpool Engineering Society.—Wednesday, February 21st. At the University, Liverpool. At 8 p.m. Paper on "High-Ratio and High-Speed Transmission Gears," by Mr. J. J. Clark.

Nottingham Society of Engineers.—Wednesday, February 21st. At the Welbeck Hotel. At 7.30 p.m. Paper on "Telephoning a Large Town," by Mr. R. I'Anson.

St. Bride Radio and Experimental Society.—Wednesday, February 21st. At St. Bride's Institute, Ludgate Circus, E.C. At 7.30 p.m. Presidential address by Capt. H. Riall Sankey, R.E. (ret.).

Greenock Association of Electrical Engineers.—Wednesday, February 21st. At 22, West Stewart Street. Exhibition of the Western Electric Co.'s film, "Telephone Manufacture," described by Mr. A. Bucklitsch.

University of London.—Wednesday, February 21st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.15 p.m. Lecture on "The Control of the Speed and Power Factor of Induction Motors," by Prof. Miles Walker. (Lecture I.)

Chemical Society.—Thursday, February 22nd. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Lecture on "Some Constitutional Problems of Carbo-Hydrate Chemistry," by Principal J. C. Irvine, F.R.S.

Chelmsford Engineering Society.—Thursday, February 22nd. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Fundamental Points in Design," by Mr. G. Bradshaw.

Roentgen Society.—Friday, February 23rd. At the Institution of Electrical Engineers. At 8.15 p.m. Joint meeting with the Physical Society. Discussion on "The Measurement of X-Rays."

Edinburgh Electrical Society.—Friday, February 23rd. At the Philosophical Institute. At 8 p.m. Paper on "Faults on a.c. and d.c. Plants," by Mr. J. Thomson.

Institution of Production Engineers.—Friday, February 23rd. At the Engineers' Club, W. At 7.30 p.m. Paper on "Machine Moulding Methods," by Mr. T. F. Hardyman.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped envelope.

The makers or suppliers of the following devices are asked for:—

Electrical boot-polishing machines.

AUTOLITE electric headlamp.

Adhesive tape, bearing trade mark a cock upon a globe and the words "While I live I'll crow."

Small bobbins (not metal) suitable for fine wire windings. Large quantity needed.

NOTES.

Parliamentary Note.—Parliament was opened by the King on Tuesday, February 13th. In the speech from the Throne, His Majesty said that the financial burdens of the country were heavy, and reductions in public expenditure remained essential to the well-being of the State. The serious state of unemployment caused him the deepest concern, and must continuously engage the attention of his Ministers. The increase which had recently taken place in our oversea trade gave ground for confidence in the future, and he earnestly trusted that we might anticipate a continued improvement in both our external and our home trade. Among the measures which would be presented for the consideration of both Houses would be Bills dealing with unemployment insurance benefit, housing, trade boards and industrial assurance. The Departmental Committee, appointed to consider the operation of the Increase of Rent and Mortgage Interest (Restrictions) Act, had now made its final reports, and proposals would be made to carry into effect certain of the Committee's recommendations.

Appointments Vacant.—Draughtsman (temporary), for the Edinburgh Corporation electricity department; engineering draughtsman (temporary), for the Hastings Corporation electricity department; meter inspector and tester, for the Holmfirth Urban District Council electricity department; chief electrical engineer (£500), for the Gillingham Borough Council electricity department. (See our advertisement pages to-day.)

"Safety First."—The British Industrial "Safety First" Association, which since the year 1918 has been carrying on the useful and much-needed task of endeavouring to reduce industrial accidents, held its fourth annual meeting at the Caxton Hall, Westminster, S.W.1, on Wednesday afternoon. From recent returns showing success in the reduction of accidents attained by its members, the Association is able to report the following striking results:—

Nature of Undertaking.	Period of Membership.	Decrease in Accidents attained per cent.
Engineering	3½ years.	76.94
Machine tools manufacture	2 years.	54.8
Electrical engineering ...	2 years.	26

One member-firm reports a decrease in two years of compensation payments of 46 per cent.

Lord Armstrong has consented to become the president of the Association for the year 1923, in succession to Viscount Leverhulme, who has acted as president of the Association since its inauguration. The annual meeting was followed by a dinner at the Trocadero Restaurant.

Post Office Engineers' Dinner.—The annual dinner of the Post Office Engineering Department, a function that is increasing in popularity from year to year, was held at the Connaught Rooms on February 9th under the chairmanship of Major T. F. Purves, when a large gathering thoroughly enjoyed a most successful evening, thanks to the hard preparatory work of the Dinner Committee. During the evening a much-appreciated musical programme, under the direction of Mr. M. F. S. Boddington, was rendered by Miss Annie Rees and Messrs. Stuart Robertson and Norman Long, Mr. H. H. Stubbs being at the piano. Following the loyal toasts, proposed by the chairman, "The Post Office Engineering Department" was proposed by the Rt. Hon. N. Chamberlain, M.P., who pointed out that no department of State concerned the "man in the street" so much as the Post Office, the modern complicated system of civilisation being dependent on efficient communication. In referring to the work done and improvements achieved in 1922, he mentioned that the Leafield radio-telegraph station was now almost self-supporting; in the telephone service, outstanding applications in that year had been reduced by 60 per cent., and new subscribers to the number of 135,000 had been added to the list. The substitution of automatic for manual telephony was a great and costly change on which a start had been made and, although it was expensive at the start, it would ultimately lead to economies. The Research Department at Dollis Hill was one of the most valuable and essential parts of the service, and in promising to assist them and to see that they were not niggardly with money, the P.M.G. appealed for team work amongst all members of the department.

In replying to the toast, Major T. F. Purves explained that they found themselves at present in comparatively smooth waters on account of the improvement in the telephone service. They were only now able to show what they could do, because the interval between the acquisition of the service and the outbreak of the war had not been sufficient to allow their development schemes to mature. Regarding the comparison that had been made between what they had done in the war period and what they were doing now, he pointed out that they could equally well do now what had been done then if they could have the same command of money. It was an infinitely easier task to construct an entirely new system than to extend the one which, on account of the sins of their fathers, they found on their hands.

Although they were now getting better value for what they spent, even present costs represented an appreciable increase on pre-war figures. He did not hope for a reduction in costs due to falls in prices, but rather to improvements and research. At present the telephone service was good value for what it cost, but it must be made cheaper.

"The Visitors" was proposed by Mr. R. McIlroy and responded to by Messrs. G. F. Preston, C.B.E., and F. Gill, O.B.E., the latter pointing out that he had been struck by the efforts that were made in the U.S.A. to teach the public "hidden things"—a policy which paid handsomely, because many of the complaints were due to ignorance. Telephone traffic increased *before* business expansion and decreased *after* a slump—a very significant fact, as it proved that the service was not a luxury, but a tool which was used to aid industry and to prevent a slump. Therefore, the service must be pushed, not because it was a business, but because it was essential to industry. The nation could well afford to spend a lot of money on the service.

The toast of "The Chairman" was proposed by Sir G. E. P. Murray, K.C.B., and was accorded musical honours.

Engineering Inspection.—The Institution of Engineerig Inspection has as its principal object the supply of skilled inspectors for all branches of engineering, including the chemical and metallurgical departments. This year's president is Mr. N. P. P. Sandberg, C.B.E., M.Inst.C.E. This evening (Friday) Mr. H. T. F. Rhodes is reading a paper on "Chemical Inspection as it is and as it should be," in which he criticises the attitude of manufacturers towards chemical inspectors.

Councillors and Criticism.—Because he had been criticised for his attitude on the electric light question, a councillor moved at a recent Grantown Town Council meeting that the reporter concerned be expelled and debarred from attending future meetings until he had made a full and public apology. The Provost, who ruled the motion incompetent, said he had taken legal opinion on the matter, and he had been informed that the Council had no power to exclude any member of the public from its meetings.

The Kinema Industry.—The magnitude of the kinema industry, a good customer of electricity suppliers, may be gauged from figures recently quoted by Mr. E. W. Day before the S.A. Institution of Engineers. He stated that no less than 250,000 miles of film were made yearly. The Eastman Kodak Co., which supplies 90 per cent. of the requirements, has a works with electrical plant aggregating from 8,000 to 10,000 h.p.; there are 2,150 separate electric motors of all sizes. On the operating side, it was said that the 20,000 larger theatres in the United States consume from 50 to 75 thousand carbons daily. The energy consumption of these kinemas was put at 270,000 kWh per day, and the value of the electrical machinery employed (apart from that at power stations) was estimated to be $11,000,000.

Lectures.—Radio-telephony.—An interesting lecture was given by Dr. H. R. Wright, a director of the company, at the Siemens' and English Electric Wireless Club on Monday last, on the rudiments of wireless telephony. A number of demonstrations were made and lantern slides were employed to illustrate the lecture. By means of a valve set, Marconi House was heard, and the members enjoyed "listening in" to the concert given by the British Broadcasting Co.

Advertising and Selling.—Mr. J. W. Beauchamp, M.I.E.E., lectured on February 10th, at the Birmingham and District Electric Club, on "Advertising and Selling in Relation to the Electrical Industry." He explained the objects of the Electrical Development Association, and emphasised the importance of co-operation among supply authorities, manufacturers, and contractors in arousing national interest in the use of electricity, and thus preparing the ground for more detailed individual selling efforts.

Mercury Arc Rectifiers.—Mr. R. L. Morrison, M.I.E.E., is to deliver a lecture under the auspices of the southern division of the Electrical Power Engineers' Association at the Institution of Electrical Engineers on March 2nd. The subject dealt with will be "High-Power Mercury Arc Rectifiers, with Special Reference to Traction Service." Mr. J. H. Parker, A.M.I.E.E., will occupy the chair.

Educational.—Faraday House Scholarship Examinations.—The annual examinations for a Faraday scholarship of 50 guineas per annum, tenable for two years in college and one year in manufacturing works, and for a Maxwell scholarship of 50 guineas per annum, tenable for one year in college and one year in works, will be held at Faraday House, on April 10th, 11th, and 12th, 1923. Exhibitions may also be awarded to candidates who acquit themselves creditably in the above examinations.

The Cathode Oscillograph.—An instrument known as the cathode oscillograph, with which it is possible to record the millionth part of a second, has been made by M. Dufour, a professor of physics at the Faculty of Sciences, Paris. Very minute currents of electricity alternating with great rapidity can be registered, and it is thought the invention will prove of value in the reception of high-speed radio messages.—*Daily Mail.*

A Libel on the Electric Light.—The danger of venturing out of one's own sphere was well illustrated by a lecture delivered by Mr. A. E. Bawtree before the Royal Photographic Society on Tuesday last. The lecturer made a series of rash and erroneous statements with regard to modern systems of lighting, and attacked the electric light so fiercely that the *Daily Express* resorted to "scare heads": "Electric Light Peril"—"Will Humanity Lose the Power of Vision?"—"Back to Candles"—after the fashion of the yellow Press. It is surprising that respectable newspapers should hold so low an opinion of the intelligence of their readers as the adoption of such methods reveals. Mr. Bawtree, it is said, advocated a return to the "open flame" for artificial lighting, alleging that the electric light was too intense, and gave forth ultraviolet rays—"eye poison." He is even said to have stated that the use of alternating current caused "induced currents" in the nervous system and produced fatigue. Writing for electrical readers, it is hardly necessary for us to say that all this is pernicious twaddle. That ultraviolet rays cannot pass through glass to an appreciable extent has been fully demonstrated—when they are required for therapeutic or other purposes, quartz bulbs have to be used. Electric lamps approach the ideal of an artificial source of light; it is in their application that mistakes are made. If the lecturer had thundered against the use of gasfilled lamps without suitable shades, of which abuse so many hideous examples are to be seen in shop windows and elsewhere, he would have been on safe ground and might have done some service to humanity. As Mr. J. W. Beauchamp aptly pointed out in the *Evening Standard*, "the principal thing required is to put an electric light where you can't look at it, and put over it a scientifically designed shade." "Glare" is the trouble to be avoided.

As we go to press we have received several communications on this subject, too late for use this week.

Automatic d.c. Sub-station.—Correction.—In our report of the discussion in London of Mr. P. J. Robinson's paper on the above subject, which appeared in our last issue (p. 238), Mr. Baldwin's initials were erroneously given as "A. H." instead of "F. G. C."

Long-distance Radio Reception.—The *Belfast Telegraph* of December 30th reported that on Christmas morning between 1 and 1 o'clock, Christmas carols and a sermon broadcast from Newark, New Jersey, U.S.A., were picked up in Belfast. The test was carried out by Mr. J. D. Morrison, of the General Electric Co., Ltd., who was listening-in on a standard "Gecophone" two-valve set. An independent check on the result was taken by Mr. A. Coates, who was able to confirm the result. On the previous night Mr. Morrison heard vocal and orchestral music from the same station. When it is remembered the "Gecophone" two-valve set is primarily designed for the reception of broadcast telephony from the British broadcasting stations, it will be realised that the results obtained on this occasion are a good indication of the sensitiveness of these instruments.

Football in Mespot.—An interesting rugger match was played at Basra on January 6th between the R.A.F. and Abadan. The latter team was made up from the men sent to Abadan by Messrs. Johnson & Phillips, Ltd., to carry out the electrification work on the Anglo-Persian Oil Co.'s oilfields. The match resulted in favour of the R.A.F. by 12 points to 3, the solitary try on the Abadan side being scored by one of the J. & P. assistant engineers, Mr. Varley. However, as the R.A.F. team was regarded as the strongest team which could be got together in Mespot, and comprised several old internationals, the Abadan men certainly do not consider themselves disgraced. The R.A.F. men, in fact, expressed their delight with the game put up, and a return match has been arranged. The Anglo-Persian Oil Co. kindly put its river steamer *Lady Curzon* at the disposal of the Abadan team to take them to Basra and back.

Gas Engines and Gas-Producer Plant.—In the course of a paper bearing the above title, read by Mr. Hugh Campbell before the Institute of Marine Engineers recently, the results of a number of tests were given. Some of these were carried out on a 100-kW vertical four-cylinder gas engine with an open-hearth producer gas plant working with small anthracite coal, for the Corporation of Doncaster. It was found that the consumption of fuel per kWh was 1.1 lb., or, assuming a generator efficiency of 90 per cent., .76 lb. per b.h.p. hour. Another test on a 250-h.p. two-cylinder horizontal side-by-side engine gave a fuel consumption of .89 lb. per b.h.p. hour. An open-hearth gas plant of 250 h.p., supplying gas to three engines, showed a fuel consumption of .95 lb. per i.h.p.-hour, the indicated h.p. at the time of the test being 204.

With sawdust as fuel, a single-cylinder 50-b.h.p. horizontal engine showed a consumption of 3.4 lb. per b.h.p.-hour over a period of eight hours. Another wood-refuse gas plant and 260-h.p. four-cylinder horizontal engine had a consumption of 2.25 lb. per b.h.p.-hour. A 50-h.p. plant employing rice husks (18.6 per cent. ash, 57.24 per cent. volatiles, 10 per cent. moisture, and 14.11 per cent. fixed carbon) gave a fuel consumption of 4.25 lb. per b.h.p.-hour.

New Audiometer.—Not only has Dr. A. M. Low devised a means (the audiometer) of detecting and photographing noise, but he has now perfected a method of reproducing sounds already recorded. Apart from the lighter and more humorous side of the device, the instrument, including a valve amplifier reproducing through a microphone, may have interest and value in the teaching of elocution and singing.—*Westminster Gazette.*

Accident.—Walter Shoebridge, railway fireman, was standing on his engine at Norwood Junction on February 8th, breaking coal, when the top of his hammer touched a live overhead wire, and he received a severe shock. His head and shoulders were burned, and he fell to the ground, fracturing his skull. He was taken to Croydon Hospital, and was later reported to be going on favourably.—*The Times.*

The Air Force Reserve.—The Air Ministry announces that it is prepared to consider applications from ex-officers and others with the necessary technical qualifications for enrolment in the Air Force Reserve of Officers. The following branches are mentioned:—Engines and rigging; wireless telegraphy and signals; photography; armament; airships and balloons; and stores.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Informal Meeting.—At the meetng of the Informal Section on February 5th, Mr. F. Pooley was in the chair, when Mr. J. Coxon opened a discussion on "The Supply of Steady D.C. for Telephonic Purposes." Mr. Coxon's remarks were confined to those telephone exchanges (of the 3,000 or so in the United Kingdom) which are large enough to require a special power installation, which may have an equable load through the night to 8 a.m., rising rapidly to a peak load of several hundred amperes about 11 a.m. He described the ripple obtained with ordinary d.c. generators, which makes some other source of supply essential. He spoke of the attempt to obtain a generator which through a choking coil would deliver a smooth current, but after a fair measure of success the search seems to have been abandoned. He then described and criticised the standard double-battery systems, which are extravagant, as one battery is only standing by, while each has a capacity equal to the full load for 36 hours, and he reviewed the method of overcoming waste of battery capacity by means of a floating battery discharging during heavy hours. Mr. Coxon exhibited several slides illustrating homopolar dynamos, and appealed for the interest of designers in special d.c. generators as a practical method of abolishing batteries. He said the main difficulties of the homopolar machines had been due to the high peripheral velocity required to obtain normal commercial voltages, but for telephone circuits low voltages were required.

Fourteen speakers joined in the subsequent discussion.

Liverpool Centre.—The Council of the Institution has granted the petition of the corporate members of the Liverpool Sub-Centre to creat a Centre, with headquarters in Liverpool,

the North-Western Centre Committee having supported the Liverpool members in their application to Council. The Sub-centre was instituted in 1919, with Dr. E. W. Marchant as chairman, with a membership of 220, which has since become 467. The area of the Centre is "that bounded by straight lines between the following towns, inclusive:—Southport, Wigan, Warrington, and in the direction of Wrexham, up to the county boundary, also the following counties:—Flint, Denbigh, Merioneth, Montgomery, Carnarvon, and the Isle of Anglesey." A meeting of corporate members has been convened for February 19th to appoint officers and a committee for the new Centre. Under the very active chairmanship of Mr. Welbourn, the Sub-Centre Committee this session has been co-operating with the North-Western Committee in making arrangements for the summer meeting of the Institution to Manchester, Liverpool, and North Wales, and the continuance of this support has been promised to the North-Western Centre.

North-Eastern Centre.—*Students' Section.*—A meeting of the Section was held in Newcastle on February 9th, when Mr. C. H. Davidson gave an address on "Electrical Machinery," illustrated with numerous lantern slides. Mr. W. N. Kilner was in the chair. The next meeting is to be held on February 23rd, when Mr. O. W. Millar will read a paper on "The Electrification of Railways."

Irish Centre.—Mr. R. N. Tweedy recently read a paper at the Irish Centre of the Institution on "The Economic Development and Co-relation of the Power Resources of Ireland," in which he outlined a policy by which, he believed, Ireland in 50 years' time could command power at a price which would compare well with the cost of power in England, and would be as self-supporting as her supplies of raw material permitted. The variety and extent of those supplies were beyond the imagination of the majority. The financial embarrassments now forced upon the State would lead to an early survey of the whole wealth of the country, and, for the same reason, it was even more important that the State should even vest in itself, for revenue purposes, the latent energy of the rivers, bogs, and coal seams. Where local industrials in Ireland had harnessed small water powers, power was costly; until it was cheapened there could be no revival of industry, nor could there be diffusion of industry, for dependence on English coal pinned Irish industries to the East Coast. A prosperous future lay in good mining of Irish coal, with good handling, cheap transport for the better grades, and the use at or near the pit bank of the poor grades and the duff or culm.

Extra Meeting.—An extra meeting of the Institution will be held on February 22nd, when Dr. H. W. Nichols will lecture on the subject of "Trans-oceanic Wireless Telephony," to be followed by a discussion. Mr. B. Welbourn will exhibit two kinematograph films illustrating the electrification of the Chicago, Milwaukee and St. Paul Railway on the same evening.

Institution of Heating and Ventilating Engineers.—In the course of his presidential address at the annual meeting on February 6th, Mr. John Watson spoke of the progress made during the Institution's 25 years of existence. He urged members to continue to support the Research Committee, which was performing valuable service. He also referred to the joint meeting with the Institution of Electrical Engineers, when proposals to use the waste heat of large generating stations, and so make them heating and power stations, were discussed. Prof. W. E. Garner, M.Sc., read a paper on the combustion of fuel in boiler furnaces, showing how empirical methods were being replaced by scientific control.

Institute of Metals.—The annual general meeting is being held at the Institution of Mechanical Engineers on March 7th and 8th. A long list of papers is expected dealing with many aspects of metallurgical science and practice. The annual dinner will take place at the Trocadero Restaurant after the first day's proceedings. Dr. W. Rosenhain is to deliver the Annual May Lecture on the 2nd of the month; he will take as his subject "The Inner Structure of Alloys." The autumn meeting of the Institute will be held at Manchester in September.

Association of Mining Electrical Engineers.—The annual dinner of the Association was held at Cardiff on February 2nd. A large number of members attended, and amongst the visitors was Mr. William Johnson, of Ffaldau Collieries, who is this year president of the South Wales Institute of Engineers, and Mr. C. T. Allan, vice-chairman of the Western Centre of the Institution of Electrical Engineers. During the course of the evening a presentation was made to Mr. R. G. Cooper, who had held the position of hon. secretary of the branch for a number of years. Mr. Theodore Stretton, in replying to the toast of "The Branch President," said that the Association was developing, but he had no doubt that the membership could still be considerably increased. He was confident that the existence of an Association such as the Mining Electrical Engineers tended towards increased efficiency of the colliery electrician. Mr. C. T. Allan, in replying to the toast of "Kindred Associations," emphasised how all scientific associations in South Wales were mothered by the South Wales Institute of Engineers, which was always willing to allow the use of its lecture rooms and committee rooms at any time they were required.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. E. Brown, of the Stepney Borough Council Electricity Department, has been appointed Consumers' Engineer in the Electricity Supply Department of the Portsmouth Corporation.

Mr. D. Shaw, of the Birmingham Corporation Tramways, has been appointed permanent-way engineer to the Sheffield Tramway Department at £500 per annum.

The Doncaster Town Council has approved the increase of the salary of Mr. Windle, borough electrical engineer, from £600 to £700, as from January 1st, 1923, and subject to annual increments of £50 to £800 per annum.

Mr. Alec. D. Chalmers, borough electrical engineer of Gillingham, Kent, for the past 20 years, has tendered his resignation. He has been associated with the undertaking for 24 years.

Maidenhead Town Council has granted the electrical engineer, Mr. Milton, three months' leave of absence, he having been advised to take a complete change.

The retirement of Mr. G. T. Milne, O.B.E., H.M. Senior Trade Commissioner in Canada, from public service took effect on February 7th. Mr. R. W. Dalton succeeds him from that date. As our readers are aware, Mr. Dalton has been in this country for some time past, and his services as Secretary for the investigation proceedings respecting the British Empire Exhibition came in for recognition and praise in Sir W. Joynson Hicks's report last week. It will be announced shortly when Mr. Dalton will be able to leave for Canada (Montreal); possibly also it may be known who will succeed him in New Zealand. One wonders whether it is really wise for New Zealand to be left without a Commissioner for so long. We trust that the Department of Overseas Trade will soon find a suitable man and let him ge tto work without delay, following up the excellent influence of his predecessor.

We learn from the *Faraday House Journal* that Mr. John Keats Catterson-Smith, M.I.E.E., who has lectured to the senior students of this College for the last two years on the "Design of Electrical Machinery," has been appointed Professor of Electrical Technology to the Indian Institute of Science, Bangalore, India. He leaves for India at the end of February, and Mr. W. J. John, A.R.C.Sc., D.I.C., Wh.Ex., A.M.I.E.E., has been appointed lecturer on Electrical Machine Design in succession to Prof. Catterson-Smith. Mr. John has had a lengthy experience in the design of electrical machinery, and is a member of the Board of Studies in Electrical Engineering of the University of London.

Obituary.—Prof. William Konrad Roentgen.—The death of Prof. Roentgen on February 10th, at the age of 78, is reported from Munich. As director of the Physical Institute of Wuerzburg, in 1895, he made the discovery of the remarkable radiation which, on account of its mysterious qualities, he named "X-rays," and which has rendered inestimable service to mankind, especially in connection with surgery and medicine. New applications of the rays are constantly being found, and in turn the Roentgen rays have opened up new fields of investigation which have led to further discoveries relating to the structure of crystals and of atoms. Roentgen's discovery—which Crookes only just failed to anticipate—made an epoch in the history of physical science, and revolutionised practice in many walks of life. Only in recent years has it been definitely proved that X-rays are identical with light rays of exceedingly short wave-length. Roentgen was awarded the Rumford Medal of the Royal Society, but avoided personal publicity, and held that the knowledge that he had benefited the human race was sufficient reward for his discovery.

Mr. A. Rowley.—We regret to learn of the death, which occurred on Friday last, of Mr. A. Rowley, who has been associated with the Siemens lamp sales organisation for the past eleven years. Mr. Rowley recently underwent two serious operations in St. George's Hospital, and although these appeared to have been fairly satisfactory, complications set in, with fatal result. He had a wide circle of friends in the electrical industry, and was well known in the London area.

Will.—The late Mr. B. S. Broadhurst (Brush Electrical Engineering Co., Ltd.) left £22,608 gross and £18,506 net personalty.

NEW COMPANIES REGISTERED.

Aerial Wire and General Manufacturing Co., Ltd. (187,514).—Private company. Registered February 2nd. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of woven copper wire, electrical, manufacturing, mechanical, and scientific instruments and apparatus, spare parts of instruments, machinery and apparatus, piano accessories, general manufacturers, engineers, &c. The first directors are:—A. Renn, 116, Highbury Hill, N.5, pianoforte manufacturer; S. C. Parke, 45, Lansdowne Road, Tottenham, N.17, piano string manufacturer. Secretary: A. Renn. Registered office: 403, Mare Street, Hackney, E.8.

Amplifiers, Ltd. (187,515).—Private company. Registered February 2nd. Capital, £800 in 500 preference shares of £1 each and 2,000 ordinary shares of 1s. each. To carry on the business of manufacturers of, and dealers in wireless apparatus, electricians, metal workers, &c. The subscribers (each with one ordinary share) are:—F. N. Wood, 7, Bucklersbury, E.C., clerk; M. V. Simons, 7, Bucklersbury, E.C., clerk. The first directors are not named. Solicitors: Billinghurst, Wood & Pope, 7, Bucklersbury, E.C.4.

The Gas and Electric Securities, Ltd. (187,522).—Registered as a private company on February 2nd with a nominal capital of £1,000 in £1 shares. The objects are:—To deal in shares, stocks, debentures, debenture stock, bonds, obligations, mortgages, scrip or other securities of railway, gas, electric power and lighting, water, canal, and other public companies, works and undertakings, &c. The subscribers (each with one share) are:—G. A. Potts, 58, Ufford Street, Blackfriars, S.E.1, clerk; F. North, 180, Vauxhall Bridge Road, S.W.1, clerk. The subscribers are to appoint the first directors. Qualification, 1 share. Remuneration as fixed by the company. The registered office is at 9, Clifford Street, W.1.

Electro-Chemical Manufacturing Co., Ltd. (187,605).—Private company. Registered February 6th. Capital, £400 in £1 shares. To carry on in the United Kingdom and elsewhere the business indicated by the title, and that of manufacturers of, and dealers in wireless apparatus, electrical appliances generally for wireless sets, &c. The permanent directors are:—Matthew Warriner, Junr., Cedar Lodge, Anglesa Road, Kingston-on-Thames; William H. Hitchcock, 40, Courtmill Street, Bayswater, W.11; Carl Reinheimer, 36, Villers Avenue, Surbiton; Aaron E. Katz, 64, First Avenue, Manor Park, E.12. Qualification, 50 shares. Registered office: 26-31, Eyre Street Hill, Clerkenwell, E.C.

British Homo Wireless Co., Ltd. (187,560).—Private company. Registered February 5th. Capital, £1,000 in £1 shares. To carry on the business of mechanical and electrical engineers, scientific instrument makers, manufacturers of telegraphic, telephonic, and wireless apparatus and accessories, &c. The first directors are:—Mrs. Maud H. H. Macnamara, 9, Sheengate Gardens, S.W.; J. S. G. Hopton, 186, Balfour Road, Ilford. Qualification, one ordinary share. Registered office: 28, Eagle Street, Holborn, W.C.

Sherborne Electric Supply Co., Ltd. (187,539).—Registered February 5th. Capital, £15,000 in £1 shares. To carry on at Sherborne and elsewhere in Dorset the business of an electricity supply company and to adopt an agreement with Edmundson's Electricity Corporation, Ltd. Minimum cash subscription, £10,000. The first directors are:—A. R. Rawlence, F.S.I., F.A.I., "Dyrham," Sherborne, Dorset; Dr. G. R. Rickett, O.B.E., M.A., "Hill House," Sherborne, Dorset; E. W. Taylor, "Cotswold," Sherborne, Dorset; A. N. Rye, M.I.E.E., 6, Eaton House, Belsize Park Gardens, N.W.3; W. E. Brandreth, A.M.I.E.E., Broad Sanctuary Chambers, Westminster, S.W. Qualification, £50. Remuneration as fixed by the company. Secretaries: Flooks and Grimley. Registered office: Greenhill, Sherborne, Dorset.

Star Lamp Co., Ltd. (187,592).—Private company. Registered February 5th. Capital, £2,000 in £1 shares. To adopt an agreement with E. J. Walker and R. Herrick and to carry on the business of electric lamp dealers as formerly carried on by the said vendors. The subscribers (each with one share) are:—E. J. Walker, 125a, High Street, Bromley, Kent, foundry engineer; R. Herrick, 5, Moss Hall Crescent, North Finchley, N.12, director of Evans (Electrical), Ltd. The first directors are:—W. Addiscott and E. J. Walker. Remuneration, £75 each per annum (chairman, £150). Registered office: 10, Bush Lane, Cannon Street, E.C.

Insulating Supplies, Ltd. (187,572).—Private company. Registered February 5th. Capital, £100 in £1 shares. To carry on the business as indicated by the title. The first directors are:—J. Portwine (chairman), "The Firs," Sydenham Hill, S.E., merchant; H. M. Harris, 135, Fordwych Road, N.W.4, managing director. Registered office: 28, John Street, Bedford Row, W.C.1.

Wireless Lights Syndicate, Ltd. (187,597).—Private company. Registered February 5th. Capital, £10,500 in 10,000 ordinary shares of £1 each and 10,000 deferred shares of 1s. each. To acquire from Eugene V. Hayes-Gratze certain inventions relating to wireless lights and signs, &c. The first directors are:—E. V. Hayes Gratze (managing director), 1, Gledhow Gardens, South Kensington, S.W.; N. J. Watson, "Sulhamstead House," Reading; G. C. Golding, "Bincleaves," Tonbridge, Kent. Qualification, 500 shares. Remuneration, £100 each per annum. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.

Prior's Television (Parent Co.), Ltd. (187,585).—Private company. Registered February 5th. Capital, £100 in £1 shares. To acquire the interest of W. Prior and/or Mrs. Riley in all their discoveries, inventions, and patents (when granted) relating to selenium cells and to electrical matters, and particularly to telegraphy; to promote subsidiary companies, &c. The subscribers (each with one share) are:—W. Wrentmore, 108, Victoria Street, S.W.1, engineer; C. E. Ralfs, 108, Victoria Street, S.W.1, merchant. The subscribers are to appoint the first directors. Secretary: W. Wrentmore.

Shaw Electrical Transmission Co., Ltd. (187,654).—Private company. Registered February 7th. Capital, £1,050 in 1,000 15 per cent. cumulative preference shares of £1 and 1,000 ordinary shares of 1s. To acquire the letters patent in respect of an invention entitled "an improved arrangement of apparatus for the electrical transmission of power," to adopt an agreement with K. R. D. Shaw, and to carry on the business of electricians, mechanical engineers, &c. The first directors are:—Dr. K. R. D. Shaw (permanent), 144, Harley Street, W.1; H. D. Wood, 22, Frith Street, Soho, W.1, kinematograph specialist. Qualification, one preference or 20 ordinary shares. Registered office: 22, Frith Street, Soho, W.1.

Lacland Electric Manufacturing Co., Ltd. (187,667).—Private company. Registered February 8th. Capital, £1,000 in £1 shares. To adopt an agreement with J. E. Manes and D. Douët and to develop and turn to account the business of electrical engineers and manufacturers of wireless receiving sets and electrical equipment referred to in the said agreement. The first directors are:—J. E. Manes, 412, Fulham Road, S.W.6, engineer (chairman); D. Douët, 10, Ruvigny Gardens, S.W.15, radio engineer. H. C. Maule shall become an additional director on his taking up 250 shares. Secretary: H. A. C. Maule. Registered office: 429b, King's Road, Chelsea, S.W.

H. P. Electrical Co., Ltd. (187,715).—Private company. Registered February 9th. Capital, £1,000 in £1 shares. To acquire the business of electrical, radio, and telephone engineers, suppliers, and contractors carried on by F. Clayton, H. Partington, and H. J. Partington at 25, Eccles New Road, Salford, as "Clayton & Partington." The permanent directors are:—F. Clayton, 25, Eccles New Road, Salford; H. Partington (managing director), 97, Littleton Road, Pendleton, Manchester; H. J. Partington, 97, Littleton Road, Pendleton, Manchester. Qualification, £100. Remuneration, £546 per annum, divided between them. Registered office: 25, Eccles New Road, Salford.

Collier's Patent Ebonite Horn Co., Ltd. (187,603).—Private company. Registered February 6th. Capital, £2,000 in 1,800 ordinary shares of £1 each and 4,000 deferred shares of 1s. each. To acquire (1) from A. T. Collier Patent No. 178,186 of 1922, and (2) the business carried on by the said vendor and H. Standring at 61 and 62, Chancery Lane, W.C., as the Collier Ebonite Horn Co., and to carry on the business of manufacturers of, and dealers in horns or amplifiers, for use with gramophones, wireless instruments, loud speakers, and similar contrivances; gramophones, musical boxes and instruments, wireless and aerial installations, &c. The first directors are:—A. T. Collier, "Danesfield," Upper Lattimore Road, St. Albans (managing director); L. W. Hudson, 86, Queen's Gate, S.W.; H. Standring, 25, Versailles Road, Anerley, S.E.20. Qualification, 100 shares. Remuneration of managing director, £260 per annum; of other directors, £50 each per annum. Registered office: Room 429, at 61 and 62, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

New Welding Co., Ltd.—Particulars filed of £300 debentures authorised December 11th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £300.

Debenture dated January 1st, 1923, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. G. Meeks, 177, Archway Road, Highgate, N.

Howard Electrical Co., Ltd.—Debenture dated January 15th, 1923, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.

Concordia Electric Wire Co., Ltd.—Debenture dated January 25th, 1923, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital, but excluding certain freehold properties. Holders: H. S. Fellows and J. F. Giles, both of 18, High Street, Burton-on-Trent.

Leeds Flint Glass Co., Ltd.—Particulars filed of £10,200 debentures authorised January 1st, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Birmingham Guild, Ltd.—Debenture dated January 30th, 1923, to secure £17,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: F. Young and J. H. Prince, 4, Temple Row West, Birmingham.

Luminor Signs (British), Ltd.—J. Barlow, of 79, King's Road, Kingston-on-Thames, was appointed receiver on February 2nd, 1923, under powers contained in debenture dated September 15th, 1922.

Yorkshire Incandescent Electric Lamp Co., Ltd.—J. A. Couper, of 17, East Parade, Leeds, ceased to act as receiver or manager on behalf of the first mortgage debenture holders on January 29th, 1923.

C. H. Hare & Son, Ltd. (110,911).—Return dated December 31st, 1922. Capital, £16,000 in 8,000 preference and 8,000 ordinary shares of £1 each. All shares taken up. £8,502 paid; £7,498 considered as paid. Mortgages and charges, nil.

George H. Scholes & Co., Ltd. (106,845).—Return dated September 14th, 1922. Capital, £8,000 in 5,000 preference and 3,000 ordinary shares of £1 each. 2,336 preference and 2,002 ordinary shares taken up. £1,952 paid; £2,386 considered as paid. Mortgages and charges, nil.

W. G. Cannon & Sons, Ltd. (87,796).—Return dated December 27th, 1922. Capital, £3,000 in £1 shares. All shares taken up. £9 paid; £2,991 considered as paid. Mortgages and charges, nil.

Cutting Bros., Ltd. (81,178).—Return dated December 7th, 1922. Capital, £40,000 in 3,000 ordinary and 1,000 preference shares of £10 each. 1,877 ordinary and 502 preference shares taken up. £10 per share called up on 1,477 ordinary, £2 per share on 400 ordinary, and £10 per share on 502 preference shares. £20,590 paid; £3,200 considered as paid on 400 ordinary shares. Mortgages and charges, £27,000.

Erith Battery Co., Ltd. (97,901).—Return dated January 3rd, 1923. Capital, £10,000 in £1 shares. 7,252 shares taken up. £1 per share called up on 2,122 shares. £1,872 paid; £5,380 considered as paid; £250 in arrears. Mortgages and charges, nil.

CITY NOTES.

Central Electric Supply Co., Ltd.

During 1922 47,187,880 kWh was supplied to the Westminster, St. James' and Pall Mall and the Chelsea companies. After making a full allowance for sinking fund and depreciation, the net balance is £4,997 plus £8 brought forward. A dividend of 5 per cent. on the ordinary shares requires £5,000, and £5 is carried forward. The report says:—

"The directors gave formal notice on September 29th, 1922, of their intention to redeem on April 1st, 1923, the £500,000 8 per cent. secured and guaranteed notes issued in April, 1921, but they have under consideration an alternative proposal which will shortly be submitted to the noteholders."

The "Underground" Group.

Metropolitan District Railway.—Final dividend of 1¼ per cent. on the ordinary stock, making 2 per cent. for the year, as against 1 per cent. £85,000 transferred to reserve and £77,075 carried forward.

London Electric Railway.—Final dividend of 2¼ per cent. on ordinary stock, making 4 per cent., as against 3¼ per cent. £90,000 transferred to reserve and £73,842 carried forward.

City & South London Railway.—Final dividend of 2¼ per cent. on the consolidated ordinary stock, making 4 per cent., as against 3¼ per cent. To reserve £46,000, carried forward £27,864.

Central London Railway.—Final dividends of 2 per cent. on undivided ordinary stock, making 4 per cent., as in the previous year, and 2 per cent. on preferred ordinary stock, again making 4 per cent. for the year. The deferred ordinary stock also receives a dividend of 4 per cent., as before.

Associated Equipment Co., Ltd.—The results do not justify the payment of a dividend.

Underground Electric Railways Co. of London, Ltd.—Subject to the confirmation of the above reports, the directors recommend the payment of the full half-year's (to December 31st, 1922) dividend on the 6 per cent. first cumulative income debenture stock, and the 6 per cent. income bonds of 1948 are also to receive the full 3 per cent. for the half-year, making 5 per cent. for the year, as against 4 per cent. £60,000 is transferred to reserve and £47,799 is carried forward.

St. James's and Pall Mall Electric Light Co., Ltd.

During 1922 the connections increased from 21,167 kW to 21,324 kW, and 15,826,507 kWh was supplied. The 5 per cent. dividend of the Central Electric Supply Co. will yield £2,500, less tax, to this company. The net profit for the year is £45,797, plus £6,119 brought forward. After paying the 7 per cent. preference dividend and a total distribution of 14½ per cent. (dividend and bonus) on the ordinary shares, £15,916 remains to be carried forward. In their last report the directors stated that the proposals made in December, 1921, by the Electricity Commissioners as regarded London were not satisfactory to this company. The Commissioners will shortly make fresh proposals, which will receive careful consideration, but the board will not assent to any scheme without the approval of the shareholders. The London Electricity Joint Committee 1920, Ltd., of which this company is a shareholder, has lodged a Bill which aims at centralising the generation of electricity for supply in the London areas served by companies and adjacent districts,and seeks to extend the tenure of the companies as regards their distribution business. A resolution approving the Bill will come before the meeting of the company on February 27th. The death of Mr. Montague Gluckstein—a director—is recorded. Sir Alexander B. W. Kennedy has been appointed a director.

Cambridge Electric Supply Co., Ltd.

For the year 1922 the profit was £22,750, plus £2,841 brought forward. £10,000 of this is placed to depreciation fund, £2,701 is absorbed by debenture and other interest, and £12,891 remains. The directors anticipate that they will be able, as from July 1st, to reduce the price for lighting to 7d. per unit, and to give a proportionate reduction for power. As the continued growth of the business has necessitated placing orders for additional machinery and cables involving considerable capital expenditure, it is proposed to offer unissued 89 ordinary shares of £10 each, and 351 debentures of £50 each, to present holders in these classes.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Lancashire Electric Light and Power.—75,000 new 6 per cent. (income tax free up to 6s. in the £) cumulative convertible first preference shares of £1 each, fully paid, Nos. 500,001 to 575,000.

The undermentioned have been ordered to be officially quoted:—

County of London Electric Supply Co.—74,230 ordinary shares of £1 each, fully paid (Nos. 1,233,781 to 1,330,000), and 75,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 2,650,001 to 2,725,000).

Companies Struck off the Register.—The following companies have been struck off the register and are thereby dissolved:—

Central Argentine Light and Power Co., Ltd.
City of Ely Electric Light and Power Co., Ltd.
Domestic Electric Co., Ltd.
Elpo Electrical Engineering Co., Ltd.
Hammersmith, City, and North-East London Railway Co., Ltd.
Lancashire Electrical Engineering Co., Ltd.
Lytham Electric Light and Power Co., Ltd.
National Electric Engineering Co., Ltd.
National Fire Alarm Co., Ltd.
Triplex Arc Lamp Co., Ltd.

Electrolytic Zinc Co. of Australasia.—A dividend (the third) of 15.77424d. is declared on the preference shares, payable on March 7th. This represents 6.17424d. per share interest accrued from date of allotment to June 30th, 1921, at 8 per cent., and 9.6d. per share for half-year ended December 31st, 1922, at 8 per cent. The payment will complete the distribution of interest on this capital from date of allotment to December 31st, 1922.—*Times.*

Prospectus.—*St. Maurice Power Co., Ltd.*—There is being offered for sale by public prospectus (the list of applications closes on Saturday) £200,000 first mortgage 30-year 6½ per cent. sinking fund debenture stock at £99½ per cent. in this company, which is a subsidiary of the Shawinigan Water and Power Co.

Brompton and Kensington Electricity Supply Co., Ltd.—According to the financial Press it was announced last week that new certificates of the issue of bonus ordinary shares of £1 each were ready for issue forthwith, and that letters of renunciation would not be accepted later than February 28th.

Parsons Marine Steam Turbine Co., Ltd.—Interim dividend of 2½ per cent. free of tax.

Northampton Electric Light and Power Co., Ltd.—Trade depression prevented any very great expansion in business, but the steady increase has been maintained. The energy sold increased by 9.2 per cent. to 8,468,479 kWh. The extensions to the Hardingstone Junction generating station are almost complete. The engineers' strike and other industrial troubles caused delay. The issues of ordinary shares and debentures made during the year were very successful. £20,309 has been added to depreciation fund, £8,000 to reserve fund, £1,000 to battery suspense fund, and £1,000 to employés' benevolent fund. A final dividend of 5 per cent. on the ordinary shares, making 9 per cent. for the year (the same as for 1921), is to be paid, and £6,774 is to be carried forward.

Rushden and District Electric Supply Co., Ltd.—The report for 1922 states that the continuance of the trade depression was reflected in a slightly smaller output of electricity, but the accounts are very satisfactory. £1,993 has been put to depreciation fund. A final dividend of 4½ per cent. (making 8 per cent. for the year) is to be paid; for 1921 the total was 7½ per cent. £1,191 is to be carried forward.

City of Buenos Aires Tramways Co., Ltd.—The net revenue for 1922 was £76,198. According to the *Financial Times*, the directors recommend a final dividend of 1s. 3d. per share (making 5s. per share, less tax), transferring £5,000 to the general amortisation fund, carrying forward £9,198. The directors announce that since printing the report and accounts they have received the decision of the Special Commissioners of Income Tax that the company is not liable to be assessed for Corporation Tax.

Charing Cross, West End and City Electricity Supply Co., Ltd.—Dividend on the ordinary share capital of the West End undertakings of the company for the half-year ended December 31st, 1922, at the rate of 7s. per share (less tax), making, with the interim dividend already distributed, 12 per cent. for the year 1922, and a bonus of 2s. per share (free of tax).

London and Suburban Traction Co., Ltd.—The board recommends payment of 5 per cent. in respect of the arrears on its 5 per cent. cumulative preference shares, against 3½ per cent. last year. £12,662 to be carried forward.

Metropolitan Electric Tramways, Ltd.—Dividend of 11½ per cent. (compared with 7 per cent. last year) on the 5 per cent. cumulative preference shares, being the balance of arrears for 1920 and 1921, and 4 per cent. for the year 1922. £2,432 carried forward.

Mather & Platt, Ltd.—Final dividend on the ordinary shares of 7 per cent., making 10 per cent. for the year, free of tax; also a bonus of 5 per cent., free of tax. £200,000 is put to reserve and £174,953 carried forward.

South Metropolitan Electric Tramways and Lighting Co., Ltd.—Final dividend of 3 per cent. on the 6 per cent. cumulative preference shares, making 6 per cent. for the year 1922; dividend of 7½ per cent. per annum on the ordinary shares; £3,234 carried forward.

North Metropolitan Electric Power Supply Co.—Dividend of 6 per cent. on the 6 per cent. cumulative preference shares; 8 per cent. on the 8 per cent. cumulative second preference shares; 10 per cent. on the ordinary shares for 1922; £7,073 carried forward.

Melbourne Electric Supply Co., Ltd.—For the year ended August, 1922, the net profit, after putting £80,000 to general reserve and £30,000 to loans redemption account, was £82,211 plus £57,039 brought forward. A further dividend of 5 per cent. is being paid, making 10 per cent., free of British income tax. £22,344 is carried forward.

Traction and Power Securities Co., Ltd.—The net revenue for 1922 was £35,245 plus £14,137 brought forward. Further dividend of 4s. 6d. per share, free of tax, making 8s. for the year. Carried forward, subject to Corporation Profits Tax, £15,218.

W. T. Henley's Telegraph Works Co., Ltd.—Final dividend on the ordinary shares of 2s. per share less income tax, making, with the interim dividend of 1s. per share, 3s. per share for the year.

Western Electric Distributing Corporation, Ltd.—Interim dividend at the rate of 6 per cent. per annum on all classes of shares for the half-year ended December, 1922.

Notting Hill Electric Lighting Co., Ltd.—Final dividend of 6s. per share, free of tax, on the deferred shares, making 10s., free of tax, for the year 1922.

London Electric Supply Corporation, Ltd.—A dividend of 10 per cent. for 1922 is announced, as compared with 4 per cent. for 1921.

Smithfield Markets Electric Supply Co., Ltd.—Dividend 6 per cent. on the ordinary shares for 1922.

STOCKS AND SHARES.

Tuesday Evening.

The principal feature of the financial week has been the declaration of electricity supply and Home Railway dividends. The announcements from the Underground companies are distinctly good, although the dividend from the District failed to meet general expectations. Optimism had looked for as much as 4 per cent. on Districts; the actual rate declared makes 3 per cent. for the year, which goes against 1 per cent. for the previous twelve-month. On this, the price of the stock went back to 47, but recovered to 49.

The Underground Electric Railways is paying 5 per cent. on the Income Bonds, against 4 per cent. a year ago, and this is quite up to anticipation, the price of the bonds improving to 95½. The London Electric and City & South London's 4 per cent. go against 3¼ per cent. for 1921, and the Central London 4 per cent. on the undivided ordinary is the same as that for the corresponding period. The London General Omnibus Co., with its 4½ per cent., making 8 per cent. for the year free of tax, is ½ per cent. better. London Suburban preference receive 5 per cent., as against 3½ per cent., and the price of the shares has hardened to 12s. There are still arrears amounting to a little under 4s. per share on these, and it is contended in the market that 15s. is not too extravagant an estimate of the level which the shares are likely to reach. The Metropolitan Railway report, although it shows a decrease in the number of passengers carried, makes excellent reading by reason of the drop in working costs, and payment of the increased dividend seems to be fully justified. The market in the various stocks has developed more activity, and the prior-charge stocks are better. City & South London preferences are all four points higher at the common price of 92¼.

Electricity supply shares continue to advance materially. Practically every day sees a substantial gain added to the leading shares. The County of London dividend is expected to be declared next week. All the announcements to date have been first-rate, and not one of the companies can have disappointed the hopes raised in the minds of its proprietary by the knowledge that the industry has enjoyed a year of unusual prosperity. It seems, moreover, as though the companies were by no means at the end of their possibilities for expansion. If they were able to obtain a longer lease of tenure, the outlook would be rosy, and from all that can be seen of the attitude both of Parliament and the L.C.C., there is a sympathy on the part of the "powers that be" towards the suggestion to grant another forty years' extension. Meanwhile, the companies are reducing their charges to customers, though some of the private consumers of electricity, for lighting purposes only, are inclined to ask whether more might not be done for them towards the reduction of their quarterly bills.

The bumper Charing Cross dividend and bonus making 14 per cent. altogether, 2 per cent. being free of tax, caused a rise of £1 in the shares to 9¼. St. James's at 10½, at the splendid 14½ per cent. dividend, are 15s. higher; Londons rose £1 to 4¼ on the increase in the dividend from 4 per cent. to 10 per cent. County of London and City of London are both about ¼ higher; so are Kensington ordinary and Metropolitans, while Chelseas gained 5s. at 8¾. It is a long time since such remarkable movements have occurred in electricity supply shares as those with which we have dealt since this year started. Amongst the provincial shares, Bromley (Kent) rose to 24s., and, of the foreign investments, Whitehall Electric debenture at 92 has gone up 3½ points within the past fortnight.

Manufacturing shares are not much affected by the extraordinary strength shown by the list of supply companies. British Insulated at 2¾ are 1/16 higher, Cromptons are equally better at 17s. 6d., and there are small rises in the preference shares of the English Electric and General Electric Companies. India Rubber ordinary advanced to 13s. 9d. In the same group, Henleys gave way to 47s., on the dividend being maintained at 15 per cent. instead of being increased, as many people hoped would be the case, to 17½ per cent.

Cable stocks are quiet, with further improvement in Anglo-American deferred to 22¾. Globe preference eased off to 11½, which is the only change in the Eastern stocks. Marconis at 2 11/16 are again 1/16 higher, and Canadians, after being 12s., reacted to 11s. 6d. United River Plate Telephones at 7½ are the fraction to the good. A sharp rise in Oriental Telephones took the price to 2¾, a jump of 6s. 3d., there being several persistent buyers. Upon the demand being satisfied, the price went back a little to 2¼, showing a gain of 3s. 9d. on the week.

St. Maurice Power Co., Ltd. (a subsidiary of the Shawinigan Water & Power Co., of Montreal 6½ per cent. sinking-fund debenture stock is being offered at 99½. It is probable that the subscription lists will close before Saturday in this week, the last day upon which they could be kept open.

Anglo-Argentine Tramways shares of both classes are distinctly harder, but the principal movement in this section is a gain of four points in Brazil Tractions to 49, in consequence of the greater favour now being extended to Brazilian issues generally. British Columbia stocks are also harder, and in Mexicans, the tendency is firm, though the falls in Mexican Light & Power bonds, recorded last week, have yet to be regained.

The rubber market is stagnant, there being no fresh interest taken in the shares, although the price of the produce remains about 1s. 6d. per lb. Movements in iron, steel and armament shares are limited to fairly distributed gains or losses of 3d. to 6d. per share, there being no decided tendency one way or the other.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend. 1920.	Dividend. 1921.	Price Feb. 13, 1923.	Rise or fall.	Yield p.c.
Brompton Ordinary	12	12	33/6†	—	£3 11 8
Charing Cross Ordinary	8	9	9¼	+1	7 16 10
do. do. do. 4½ Pref.... ...	4½	4½	4 7/16xd	+1/9	5 7 5
Chelsea	6	6	8¾	+ ¼	5 19 5
City of London	14	14	48/-	+2/3	5 16 8
do. do. 6 per cent. Pref. ...	6	6	23/-	—	5 4 4
County of London	8	8	35/-	+2/6	4 11 5
do. do. 6 per cent. Pref. ...	6	6	1½	—	5 4 4
Edmundson's Ordinary	Nil	Nil	2¼	—	Nil
do 6 per cent. Pref. ...	6/-	12/-	4¾	—	6 13 4
Kensington Ordinary	9	10	8¾	+ ¼	6 15 2
London Electric	2½	4	4½	+1	3 16 2
do. do. 6 per cent. Pref. ...	6	6	5¼	—	5 17 1
Metropolitan	7	7	7	+ ¼	5 0 0
do. 4½ per cent. Pref. ...	4½	4½	4 1/16	—	5 10 9
Newcastle-on-Tyne Ordinary ...	8	Nil	1 1/16	—	Nil
do 5 per cent. Pref. ...	5	5	15/9	—	6 7 0
do 7 per cent. Pref. ...	—	7	22/6	+6d.	6 4 6
Notting Hill, 6 per cent. Pref. ...	6	6	9¼	—	6 9 9
North Met. Elec., 6 per cent. Pref. ...	6	6	1 1/16	—	5 13 0
Urban Ordinary	Nil	Nil	1½	—	Nil
do 5 per cent. Pref. ...	2½	2½	4¼	—	6 1 3
St. James' and Pall Mall	12	12	10½	+ ¾	6 18 1
South London	7	7	4¾	—	5 18 0
South Metropolitan Pref.	7	7	1 7/16	—	5 18 0
Westminster Ordinary	10	10	9	—	5 11 1
Whitehall Elec. Inst., 7½ per cent. Pf.	—	7½	19/-	—	7 18 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	6	6	103½	—	5 16 0
do. Def.	1½	34/6	22¾	+ ¾	6 13 0
Chile Telephone	6	6	5¾	—	4 16 0
Cuba Sub. Ord.	7	7	7¾	—	9 0 8
Eastern Extension	10	10	19	—	5 5 3
Eastern Tel. Ord.	10	10	189½	—	5 5 6
Globe Tel. and T. Ord.	10	10	19	—	5 5 3
do. do. Pref.	6	6	11¼	— ¼	5 7 10
Great Northern Tel.	24	22	27	—	8 2 0
Indo-European	10	10	35½	—	7 1 0
Marconi...	25	15	2 11/16	+ 1/16	5 11 6
Oriental Telephone Ord.	12	12	2¾	+ 3/16	*4 11 5
United R. Plate Tel.	8	8	7¾	+ ¼	*5 14 4
West India and Panama	Nil	Nil	7/6	—	Nil
Western Telegraph	10	10	18¾	—	*5 6 8

Home Rails.

Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2½	61½	+ ¼	5 13 10
do. District	Nil	1	49	—	6 2 5
Underground Electric Ordinary... ...	Nil	Nil	3	—	Nil
do. do. "A"	Nil	Nil	7/6	+6d.	Nil
do. do. Income	2	4	25½	+2	*5 5 3

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5½	12½	3 1/16	— 3/16	7 19 2
do. do. 2nd Pref.	Nil	5½	3¾	+ ¼	8 5 6
do. do. 5 per cent. Deb. ...	5	5	82	—	6 2 0
British Electric Traction Ordinary ...	4½	—	68½	+2	6 11 5
do 6 per cent. Pref. ...	6	6	97	+1	6 3 9
Brazil Tractions	Nil	Nil	49	+4	8 3 4
British Columbia Elec. Rly. Pcc. ...	5	5	81½	+1	6 2 8
do. do. Preferred ...	5	9/-	76½	+1	*6 2 6
do. do. Deferred ...	8	12/-	90½	—	*6 18 6
do. do. Deb.	4½	4½	76½	−1	5 11 1
Lond. and Sub. Trac., 5 per cent. Pf....	2½	3½	12/-	—	8 5 8
London United Tram deb.	4	4	62½	—	6 8 0
Mexico Tram. 5 per cent. Bonds ...	Nil	Nil	78½	—	6 7 5
do. 6 per cent. Bonds ...	Nil	Nil	87½	+1	Nil
Mexican Light Common...	Nil	Nil	19½	—	Nil
do. Pref.	Nil	Nil	49½	—	Nil
do. 1st Bonds.	Nil	5	63½	—	7 17 6

Manufacturing Companies.

Babcock & Wilcox	15	16	8 7/16	—	4 13 0
British Aluminium Ord.	10	5	17/9	−6d.	5 12 8
British Insulated Ord.	15	15	2¾	+ 1/16	6 6 4
Callenders	15	15	2 5/16	—	6 13 4
do. 6½ Pref....	6½	6½	1 7/16	+ 1/16	5 9 5
Crompton Ord.	10	5	17/6	+ 1/2	5 14 4
Edison-Swan	10	Nil	3/3	—	Nil.
do. do. 5 per cent. Deb.	5	5	61	—	8 1 4
Electric Construction	10	10	1¾	—	7 5 6
English Electric	8	5	17/3	—	5 16 0
do. do. Pref.	6	6	1 1/32	+ 1/32	5 16 3
Gen. Elec. Pref.	6½	6½	22/3	+6d.	5 19 6
do. Ord.	10	5	19/8	—	5 4 0
Henley	15	15	2 11/32	+ 1/32	6 8 0
do. 4½ Pref.	4½	4½	4¾	—	5 2 10
India-Rubber	10	—	13/9	+9d.	—
Met.-Vickers Pref.	8	8	2 7/16	—	6 11 2
Siemens Ord.	10	10	19/6	—	Nil.
Telegraph Con.	20	20	25½	—	*4 11 6

* Dividends paid free of Income Tax.
† New shares.

SWISS ELECTRICAL TRADE STATISTICS.

The following statistics, showing the import and export trade of Switzerland in electrical and allied goods, have been taken from the recently-issued official trade returns relating to the year 1921. The figures for 1920 have been set beside them, and notes added of any increases or decreases.

IMPORTS.

	1920 Fr.	1921 Fr.	Inc. or dec. Fr.
Electric cable, not insulated.—			
Total	212,000	53,000	– 159,000
From Germany	23,000	29,000	+ 6,000
,, France	188,000	18,000	– 170,000
,, United States ...	—	4,000	+ 4,000
Electric cable not lead covered, or iron armoured, insulated wire.—			
Total	154,000	151,000	– 3,000
From Germany	55,000	110,000	+ 55,000
,, United Kingdom ...	15,000	1,000	– 14,000
,, France	39,000	15,000	– 24,000
,, Italy	20,000	15,000	– 5,000
Cable covered with lead.—			
Total	171,000	32,000	– 139,000
From Germany	24,000	20,000	– 4,000
,, Austria	—	12,000	+ 12,000
Cable covered with lead and iron armoured.—			
Total	2,624,000	1,170,000	– 1,454,000
From Germany	2,097,000	970,000	– 1,127,000
,, Italy	475,000	85,000	– 390,000
,, United Kingdom ...	—	50,000	+ 50,000
,, France	2,000	41,000	+ 39,000
Cable insulated with rubber or paper and covered with textiles.—			
Total	239,000	474,000	+ 235,000
From Germany	100,000	359,000	+ 259,000
,, Italy	67,000	18,000	– 49,000
,, France	19,000	23,000	+ 4,000
,, Belgium	30,000	68,000	+ 38,000
Cable ditto covered with lead.—			
Total	772,000	430,000	– 342,000
From Germany	31,000	191,000	+ 160,000
,, Belgium	63,000	172,000	+ 109,000
,, Italy	442,000	37,000	– 405,000
Dynamo-electric machines and electric transformers.—			
Total	1,758,000	1,733,000	– 25,000
From Germany	26,000	101,000	+ 75,000
,, France	—	30,000	+ 30,000
,, Italy	97,000	80,000	– 17,000
,, United Kingdom ...	236,000	147,000	– 89,000
,, United States ...	2,283,000	2,199,000	– 84,000
Accumulators, batteries, electrodes in combination with rubber or celluloid.—			
Total	561,000	472,000	– 89,000
From Germany	234,000	243,000	+ 9,000
,, Italy	80,000	16,000	– 64,000
,, France	52,000	44,000	– 8,000
,, United States ...	43,000	90,000	+ 47,000
,, Austria	119,000	30,000	– 89,000
Accumulators, &c. (other).—			
Total	276,000	226,000	– 50,000
From Germany	224,000	200,000	– 24,000
,, France	30,000	13,000	– 17,000
Electric locomotives.—			
Total	24,000	11,000	– 13,000
Steam engines, cranes, pumps, turbines, &c.—			
Total	436,000	588,000	+ 152,000
From Germany	271,000	464,000	+ 193,000
,, United Kingdom ...	12,000	71,000	+ 59,000
,, Austria	29,000	28,000	– 1,000
,, France	66,000	13,000	– 53,000
Electric arc lamps.—			
Total	27,000	15,000	– 12,000
From Germany	26,000	14,000	– 12,000
Electric incandescent lamps, unmounted.—			
Total	9,000	8,000	– 1,000
From Germany	4,000	2,000	– 2,000
,, France	—	5,000	+ 5,000
Electric incandescent lamps, mounted.—			
Total	3,130,000	2,276,000	– 854,000
From Germany	1,677,000	803,000	– 874,000
,, Austria	457,000	857,000	+ 400,000
,, Holland	631,000	449,000	– 182,000
,, United Kingdom ...	1,000	3,000	+ 2,000
Insulators, mounted.—			
Total	477,000	762,000	+ 285,000
From Germany	209,000	104,000	– 105,000
,, United Kingdom ...	11,000	8,000	– 3,000
,, United States ...	252,000	639,000	+ 387,000
Electric meters.—			
Total	1,650,000	1,937,000	+ 287,000
From Germany	1,451,000	1,823,000	+ 372,000
,, France	135,000	69,000	– 66,000
,, United Kingdom ...	33,000	21,000	– 12,000
Telegraph and telephone apparatus.—			
Total	3,722,000	2,195,000	– 1,527,000
From Germany	1,812,000	1,514,000	– 298,000
,, United Kingdom ...	349,000	89,000	– 260,000
,, Sweden	155,000	4,000	– 151,000
,, France	123,000	138,000	+ 15,000
,, United States ...	344,000	43,000	– 301,000
,, Belgium	788,000	396,000	– 392,000

EXPORTS.

	1920 Fr.	1921 Fr.	Inc. or dec. Fr.
Dynamo electric machines and electric transformers of all kinds.—			
Total	41,409,000	42,603,000	+ 1,194,000
To Germany	585,000	580,000	– 5,000
,, Austria	64,000	90,000	+ 26,000
,, France	13,488,000	7,907,000	– 5,581,000
,, Italy	1,231,000	1,633,000	+ 402,000
,, Belgium	3,540,000	6,012,000	+ 2,472,000
,, United Kingdom ...	1,647,000	3,225,000	+ 1,578,000
,, Egypt	411,000	664,000	+ 253,000
,, Spain	6,628,000	5,491,000	– 1,137,000
,, British India ...	12,000	608,000	+ 596,000
,, Brazil	631,000	832,000	+ 201,000
,, Argentine	762,000	764,000	+ 2,000
,, Netherlands ...	5,787,000	3,604,000	– 2,183,000
,, Norway	1,053,000	3,230,000	+ 2,177,000
,, Netherlands Indies	1,237,000	1,738,000	+ 501,000
,, China	169,000	1,555,000	+ 1,386,000
,, Japan	670,000	1,576,000	+ 906,000
Accumulator batteries, electrodes in combination with rubber or celluloid.—			
Total	32,000	17,000	– 15,000
To Germany	—	1,000	+ 1,000
,, France	4,000	2,000	– 2,000
,, Italy	1,000	1,000	—
,, United Kingdom ...	3,000	2,000	– 1,000
,, Spain	19,000	5,000	– 14,000
,, Portugal	1,000	6,000	+ 5,000
Cable not lead covered or iron armoured, insulated wire.—			
Total	1,443,000	995,000	– 448,000
To France	411,000	373,000	– 38,000
,, United Kingdom ...	78,000	279,000	+ 201,000
,, Czecho Slovakia ...	348,000	137,000	– 211,000
,, Austria	62,000	89,000	+ 27,000
Accumulators, &c. (other).—			
Total	110,000	76,000	– 34,000
To France	6,000	7,000	+ 1,000
,, Italy	10,000	5,000	– 5,000
,, Egypt	1,000	10,000	+ 9,000
,, Greece	10,000	19,000	+ 9,000
,, Spain	42,000	14,000	– 28,000
,, Netherlands Indies ...	—	7,000	+ 7,000
Insulators, mounted.—			
Total	244,000	498,000	+ 254,000
To Germany	31,000	134,000	+ 103,000
,, France	40,000	93,000	+ 53,000
,, Holland	71,000	81,000	+ 10,000
,, Italy	5,000	88,000	+ 83,000
,, Sweden	—	18,000	+ 18,000
,, Spain	42,000	39,000	– 3,000
Electric cable, uninsulated.—			
Total	359,000	58,000	– 301,000
To France	4,000	3,000	– 1,000
,, Belgium	39,000	6,000	– 33,000
,, Spain	—	3,000	+ 3,000
Cable, lead-covered.—			
Total	74,000	42,000	– 32,000
To Austria	12,000	28,000	+ 16,000
,, China	—	10,000	+ 10,000
Cable, lead-covered and iron armoured.—			
Total	107,000	261,000	+ 154,000
To Greece	9,000	81,000	+ 72,000
,, Turkey	—	64,000	+ 64,000
,, Poland	1,000	52,000	+ 51,000

*Largely to Germany and Austria.

	1920 Fr.	1921 Fr.	Inc. or dec. Fr.
Cable, insulated with rubber or paper and covered with textiles.—			
Total	135,000	594,000	+ 459,000
To France	62,000	15,000	− 47,000
,, Portugal	2,000	69,000	+ 67,000
Electric locomotives.—			
Total	33,000	420,000	+ 387,000
To Sweden	—	85,000	+ 85,000
,, Brazil	—	219,000	+ 219,000
Telegraph and telephone apparatus.—			
Total	545,000	201,000	− 344,000
To France	34,000	25,000	− 9,000
,, Italy	62,000	49,000	− 13,000
,, Holland	22,000	17,000	− 5,000
,, Spain	49,000	8,000	− 41,000
,, Belgium	3,000	49,000	+ 46,000
Electric incandescent lamps, mounted.—			
Total	5,249,000	4,564,000	− 685,000
To Austria	37,000	760,000	+ 723,000
,, France	541,000	312,000	− 229,000
,, Italy	3,029,000	2,512,000	− 517,000
,, Portugal	62,000	58,000	− 4,000
,, Spain	51,000	21,000	− 30,000
,, Greece	316,000	57,000	− 259,000
,, British India	61,000	99,000	+ 38,000
,, United Kingdom ...	123,000	149,000	+ 26,000
,, Egypt	74,000	115,000	+ 41,000

	1920 Fr.	1921 Fr.	Inc. or dec. Fr.
Electric incandescent lamps, unmounted.—			
Total	8,000	4,000	− 4,000
To France	6,000	2,000	− 4,000
,, Austria	—	2,000	+ 2,000
Electric meters.—			
Total	12,676,000	8,925,000	− 3,751,000
To Germany	77,000	35,000	− 42,000
,, Austria	17,000	36,000	+ 19,000
,, France	1,837,000	1,825,000	− 12,000
,, Italy	2,457,000	861,000	− 1,596,000
,, United Kingdom ...	1,849,000	1,591,000	− 258,000
,, Belgium	1,673,000	1,728,000	+ 55,000
,, Spain	1,451,000	378,000	− 1,073,000
,, Japan	247,000	359,000	+ 112,000
,, Netherlands	805,000	222,000	− 583,000
,, Czecho-Slovakia ...	327,000	776,000	+ 449,000
Steam engines, cranes, pumps, turbines, &c.—			
Total	17,282,000	22,151,000	+ 4,869,000
To Germany	1,899,000	825,000	− 1,074,000
,, France	5,952,000	3,679,000	− 2,273,000
,, Belgium	1,930,000	4,270,000	+ 2,340,000
,, Holland	409,000	2,464,000	+ 2,055,000
,, British India	—	352,000	+ 352,000
,, Japan	1,493,000	2,962,000	+ 1,469,000
,, United Kingdom ...	1,293,000	2,695,000	+ 1,402,000
,, Spain	1,167,000	751,000	− 416,000
,, China	661,000	1,360,000	+ 699,000
,, Argentina	999,000	895,000	− 104,000

THE MID-LANCASHIRE ELECTRICITY DISTRICT.

The Electricity Commissioners will open an inquiry at Preston an February 20th, to consider schemes submitted by the Corporations of Blackburn and Preston, and by the North-East Lancashire Electricity Committee (representative of Burnley, Accrington, Colne, Darwen, Nelson, Rawtenstall, and Brierfield.

Blackburn and Preston Scheme.

This scheme provides for the establishment of a Joint Electricity Authority for the delimited area, comprising the industrial area between Preston and Colne, and the large residential area on the coast between Fleetwood and Lytham. The industrial portion of the district is a most important region representing all branches of the cotton industry, in which 150,000 workers are engaged. In addition there are important engineering works in the district.

The scheme (the technical portion of which was prepared by Mr. J. A. Robertson, M.I.E.E.) proposes that during the period from 1922 to 1931, the existing stations, except those at Blackburn (Whitebirk) and Rawtenstall, should be gradually closed down and that the normal supplies for the whole district should be furnished by three capital stations at Preston, Blackburn (Whitebirk), and Burnley, which would be interconnected with each other. The Whitebirk station at Blackburn is equipped with 20,000 kW of plant, to be extended to 30,000 kW during the period 1926/31. The initial capacity of the Preston station will be 20,000 kW, to be extended to 40,000 kW before 1931. The condensing facilities at Preston are estimated to be sufficient for a station of 100,000 kW. The initial capacity of the Burnley station to be erected between 1926 and 1931 will be 20,000 kW, but provision will be made for extending the station to 30,000 kW.

The system of supply will be three-phase, a.c., at 50 cycles per second. The main transmission pressure will be 33,000 volts, and the local secondary transmission pressure 6,600 volts, to coincide with the pressure now in use. It may be possible at 1925/26 to adopt a 66,000-volt pressure between Preston and Blackpool. It is recommended that no further extensions beyond those already sanctioned should be carried out at existing stations, except at Blackburn (Whitebirk station). It is proposed that the construction of the station at Preston shall be accelerated so that supplies may be given from it not later than January, 1924. The laying of the main transmission line between Preston and Blackburn would be proceeded with.

On March 31st, 1920, there were in the district 15 generating stations owned by 11 local authorities, the total plant capacity being 43,006 kW and the maximum demand 25,947 kW; in 1926 the estimated maximum demand will be 66,670 kW. and in 1931 99,600 kW. During 1919-20 the population of the authorised areas of supply was 695,973, the total energy generated amounted to 54,946,670 kWh, and the coal consumption was 114,043 tons (the lowest being 3.04 and the highest 8.53 lb. per kWh). At four places refuse destructors are used in conjunction with coal-fired boilers.

Portion I.—During the first portion of the scheme up to 1925/26 eight generating stations (*i.e.*, those at Accrington, Blackburn (Whitebirk), Blackpool, Burnley, Fleetwood, Nelson, Rawtenstall, and St. Annes) will be retained, while five stations (*i.e.*, those at Bispham with Norbreck, Blackpool and Fleetwood tramway station (both already closed down), Blackburn (Jubilee Street), and Preston (Crown Street and tramway stations), will be closed down. A new 20,000-kW station will be built on the river Ribble by the Preston Corporation.

Three transmission lines (25¼ miles) will be needed, each consisting of two 0.2 sq. in., 33,000-V, 30,000-kVA cables, while two 6,600-V, 3,000-kVA interconnecting mains are in course of construction (February, 1922, cost not included in the estimates for the scheme).

The estimated capital expenditure for the first part of the scheme is: new 20,000-kW generating station, £420,000; transmission lines, £202,000; switchgear, £62,000; transformers and boosters, £57,875; or a total of £741,875.

Portion II.—Development during the second portion of the scheme from 1926 to 1931 will involve the erection by the Burnley Corporation of a new generating station with an initial capacity of 20,000 kW; the extension of the Preston station by 20,000 kW to make 40,000 kW, and of the Blackburn station by 10,000 kW to make 30,000 kW; and the retention of the existing Rawtenstall station with an economical capacity of 10,000 kW. The existing stations at Accrington, Blackpool, Burnley, and Nelson, with an economical total capacity of 38,000 kW, will be used for peak-load or emergency purposes only, while the Fleetwood, St. Annes, Darwen, and Colne stations will be scrapped.

Eight transmission lines will be needed, with a total length of 61¾ miles.

The total capital cost of developments under the second part of the scheme will be: power stations and extensions, £820,000; transmission lines, transformers, switchgear, &c., £470,225; or a total of £1,290,225, which, added to the cost of the first portion of the scheme, makes a grand total of £2,032,100.

North-East Lancashire Electricity Committee's Scheme.

It is proposed to establish a Mid-Lancashire Electricity Board (the estimated cost of administering which will not exceed £1,000 per annum) to consist of 31 members. Under this scheme there will be appointed by the constituent authorities, at the commencement of each official year of the Board, an Engineering Advisory Committee to assist the Board; one engineer is to be appointed to the Committee by each authorised undertaker, and the Committee may co-opt an electrical engineer of any of the railway companies in the area.

In order to conserve capital the existing stations will be re-organised and extended to their economic limit before large capital expenditure is made on new stations and transmission lines. The interconnection mains in existence number 13 (a total length of 18.52 miles at pressures of 3,300 and 6,600 V) and are owned by eight municipal authorities, in addition to which a 2.2-mile 6,600-V, 2,500-kVA-cable links Rawtenstall with the Lancashire Electric Power Co. at Edenfield (South-East Lancashire Area) and is capable

of being used as an interlink. The present cost of production varies from 0.887 to 3.014d. per kWh generated.

Regarding the North-East Lancashire District, interconnecting mains will be laid to assist those undertakings requiring supplies during the progress of the scheme, and for reciprocal supplies. A similar arrangement will be made with respect to the Fylde District (Blackpool, Fleetwood, and St. Annes), but in this case the existing Blackpool non-standard system will be supplied through frequency changers.

As with the above-outlined alternative scheme the Committee's scheme proposes to standardise the three-phase, a.c., 50-cycle system, with a main transmission pressure of 33,000 volts and a secondary distributing pressure of 6,600 volts.

Portion I.—During the first portion of the scheme up to 1925-26, the Committee proposes to utilise ten existing generating stations (as against eight in the above-outlined alternative scheme, those at Colne and Darwen being included), whilst five will be shut down. Transferring two 2,000-kW turbines from Jubilee Street to Whitebirk at Blackburn will make the total existing economical generating capacity 76,150 kW (64,500 kW normal) and a new 12,000-kW (6,000 kW normal) station will be needed at Preston. (The above alternative scheme requires a 20,000-kW station on the river Ribble.) At the under-mentioned stations extensions, in addition to those already authorised, will be carried out, namely: Blackpool, 5,000 kW; Fleetwood, 1,000 kW; Nelson, 3,000 kW; Rawtenstall, 5,000 kW to the turbine plant only, not boilers. By developing on the lines indicated the normal full-load capacity of the eleven stations forming part of the scheme will, in 1925-26, allowing for stand-by plant, be 61,850 kW, the maximum demand being 47,850 kW, and the coal consumption will vary from 2 to 4 lb. per kWh in the different stations. In 1925-26 the Burnley and Darwen stations will be short of supplies of electricity by 2,500 and 1,000 kW respectively, which shortage will be made up by Accrington and Blackburn.

During the first period of development it is proposed to lay six interconnecting 0.2-sq. in. 33,000 and 6,600-volt mains, a total length of 36 miles.

The capital expenditure up to 1925-26 will be: on generating plant, £340,000; on interconnecting mains, £136,000; and on transformers and switchgear, £66,367; or a total of £542,467.

Portion II.—For development under the second portion of the scheme from 1926-27 to 1930-31 a new generating station will be built at Padiham by the Burnley Corporation or a joint station under the Electric Lighting Act of 1909. The total and normal capacities will be 18,000 and 12,000 kW respectively. At the undermentioned stations extensions, in addition to those already authorised, will be carried out, namely: Accrington, 6,000 kW of turbines; Blackburn, 10,000 kW of turbines; Blackpool, 5,000 kW of boilers; Preston, 6,000 kW of turbines and 6,000 kW of boilers; so that by 1930-31 the total normal capacity of the 12 stations forming part of the scheme—allowing for stand-by plant—will be 90,350 kW, the maximum demand being 85,350 kW and the coal consumption varying from 2 to 4 lb. per kWh. In 1930-31 the following districts will be short of electricity, namely: Burnley, by 10,000 kW; Colne, by 1,000 kW; Darwen, by 2,000 kW; Nelson, by 1,000 kW; and St. Annes, by 500 kW; this shortage will be made up by Padiham and Accrington, 12,000 kW; Blackburn (Whitebirk), 2,000 kW; and Blackpool, 500 kW. In the event of a breakdown at Accrington, Burnley, Nelson, or Colne, Rawtenstall will assist the system *via* Haslingden.

During the second period of development it is proposed to lay two 3.5-mile, 0.2 sq. in., 15,000-kVA, 33,000-V underground cables between Padiham and Burnley.

The capital expenditure for the second period of the scheme from 1926-27 to 1930-31 will be: for generating plant, £558,000; for interconnecting mains, £31,000; and for transformers and switchgear, £14,273; or a total of £603,273; which, added to the cost of the first period, makes a grand total of £1,145,740.

ELECTRICAL RESISTANCE FURNACES AND THEIR USES.

At a meeting of the Royal Society of Arts on Wednesday, February 7th, Mr. Charles R. Darling read a paper on the above subject. The chair was occupied by Sir Robert Hadfield.

In his opening remarks, Mr. Darling said that the electrical resistance furnace, in its various forms, was finding a continously extending application in industrial processes. The laboratory furnace introduced by Heræus in 1902, consisted of a porcelain refractory tube round which a strip of platinum foil was wound in spiral form. One of the drawbacks to the use of this was that, if it was placed directly across the power mains, arcing was likely to occur, resulting in the burning-out of the winding. Therefore, it was necessary to use an external resistance in the circuit to reduce the current at starting, and gradually to cut out this resistance as the temperature rose, thus wasting time and energy. In spite of this defect, however, the platinum-wound furnace was found to be preferable to gas heating for many purposes, and was still used for temperatures between 1,000 and 1,500 deg. C. Any material present in the refractory tube which attacked the platinum caused the winding to fuse; alundum was probably the best material at present available for the tubes. The chief factor in the great development since attained by metal-wound furnaces was the introduction of nickel-chromium alloys. These could be heated for long periods to 1,000 deg. C. without oxidising or undergoing other deterioration, and offered a nearly constant resistance to electricity at all temperatures, so that a furnace wound with such material could be coupled directly to the mains without danger of burning out. Metal-wound furnaces would never have found a place in industry had not these alloys, or others possessing similar properties, been discovered.

Mr. Darling then described, with the aid of lantern slides, some typical examples of modern commercial nickel-chromium furnaces. These were used in the laboratory for experimental work on the heat treatment of metals, for incinerations and chemical combustions, standardising pyrometers, &c., and in the workshop for hardening and tempering carbon-steel articles. In some of the large American factories, batteries of these furnaces were used for hardening gear wheels and other parts of machinery, the objects being heated to about 10 per cent. above the recalescence point, and then allowed to quench in a bath placed immediately beneath the furnace. This procedure ensured uniform results, and was cleanly and cheaper to operate than gas heating. The nickel-chromium furnace was worthy of a much wider application in this country than it had yet received.

Furnaces in which the winding was fixed to the inside of the refractory chamber instead of the outside, in order to avoid delay in heating the interior through the refractory materials being poor conductors of heat, could only be applied in cases in which the winding was not liable to damage from impact with the articles undergoing treatment. In connection with the relation between the temperatures of an external winding and the interior walls, on starting from the cold the difference between these temperatures was considerable, but when a steady condition had been reached, in the region of 900 deg. C., this difference was only about 10 deg. C., as shown by Barfield's experiments. Thus, the interior of a furnace could be raised to a temperature approaching the safety point of the winding without risk of a burn-out.

Up to the present no generally satisfactory metal-wound furnace had been designed for continuous use above 1,000 deg. C., or, at the most, 1,100 deg. C. The need for a furnace for the treatment of high-speed steel, involving temperatures between 1,300 and 1,400 deg. C. was generally recognised, but no metal or alloy had yet been found entirely suitable. Higher temperatures still were required for the annealing of the tungsten wire used for electric lamps. What was really wanted was a cheap alloy capable of withstanding 1,800 deg. C. without oxidising, and which would have a low temperature coefficient for electricity. The metals of the highest melting points, such as molybdenum (2,600 deg. C.), and tungsten (3,200 deg. C.), although fairly cheap, oxidised rapidly in air. The annealing of tungsten wire was carried out in furnaces wound with molybdenum or tungsten, arrangements being made to maintain an atmosphere of hydrogen throughout the furnace—a troublesome procedure which must always act as a deterrent to their general adoption. Owing to the high temperature coefficient of these metals, care must be exercised when starting from the cold, so that an unduly large current was not passed through the windings. Mr. Darling believed that such an alloy as he had suggested could be made, because there were materials which melted well above 2,000 deg., and it was only a question of getting the right alloy to construct a furnace which would treat high-speed steel in the workshop just as easily as the nickel-chromium furnace would treat carbon steel. Many people were working on the production of this alloy, and their efforts were fairly certain to be crowned with success.

At present ordinary refractories were not satisfactory, and we were very badly in need of some refractory which could be made easily and would not show signs of deterioration at very high temperatures. The best at present were the carborundum refractories, but there appeared to be difficulty in making them on such a scale and with such certainty as was needed for high-temperature furnaces. The solution probably lay in the direction of zirconia or magnesia, or a mixture of the two.

Carbon resistance furnaces were then considered, the three chief types being (1) tube furnaces; (2) granular carbon furnaces; and (3) furnaces in which the refractory chamber was heated by carbon rods or strips through which the current circulated. With regard to the carbon-tube furnace, useful for special operations demanding a temperature of from 2,000 to

2,500 deg. C. he described this, and pointed out that a special source of current was needed owing to the low resistance of the tube, through which the current might be 100 amperes at a pressure of 10 volts. This involved the use of a special transformer when the furnace was operated from ordinary a.c. mains. Greater simplification was needed before tube furnaces could be used in workshop routine.

Mr. Darling then illustrated a granular carbon furnace, in which the current was passed through a layer of carbon particles (of a size retained on a 20-mesh sieve) which surrounded the refractory chamber, intended for the testing of refractory materials. For a heated length of eight inches and a diameter of 2½ inches, 10 kW was required for a temperature of 1,700 deg. C., the current being 125 amperes and the voltage 80 volts. This furnace could be used on 100-volt mains—although wastefully—by using an external resistance, and on mains specially provided for arc welding (70 or 80 volts) it could be run with the maximum economy. One of the chief defects of granular resistance was the tendency to irregular heating, owing to lack of uniformity in packing. To overcome this, furnaces had been made with a number of electrodes entering round the sides, and connected to switches, which enabled the current to pass between any given pair, so controlling the temperature in sections. Another drawback was the absence of a good refractory material which would withstand 2,000 deg. C. The granular furnace possessed the advantage of cheapness, and the current strength was such that a transformer was not needed to reduce the voltage from suitable mains, so that a direct-current supply could be used. A form of furnace, due to Hancock, consisting of a number of carbon rods in series, running along the outside of the refractory chamber, and forming a kind of cage round it was then described. The ends of the separate rods were connected by graphite strips, and both were preserved from oxidation by covering with a carborundum composition, highly compressing and then baking at a high temperature. Carbon treated in this manner was highly resistant to oxidation, and by using a number of rods in series sufficient resistance could be built up to enable the furnace to be attached to mains. A furnace of 4 inches diameter, with 14 inches of heated length, consumed 5 kW at 1,000 deg. C., and 8 kW at 1,500 deg. C., and with a satisfactory refractory a temperature of 2,000 deg. C. could be obtained. This furnace appeared to be the best at present available for the workshop treatment of high-speed steels, the prevention of oxidation of the carbon being overcome without the uses of special gases or vacuum pumps.

Dealing with appliances used in conjunction with resistance furnaces, Mr. Darling said that a very useful addition to a furnace used for hardening carbon steel was some form of magnetic detector. Experience had shown that the best temperature at which to remove an article for quenching was that at which demagnetisation was just complete, which was somewhat higher than that of decalescence, and as the loss of magnetic properties was not abrupt, a good magnetic detector should be capable of indicating the final stage of demagnetisation. It should, moreover, for general utility, be adapted for either a d.c. or an d.c. circuit. Mr. Darling heated a steel wire by electricity, the wire expanded, but when the current was switched off it cooled to a point, then expanded again and ultimately cooled completely. With the aid of a magnet he showed that the wire was non-magnetic when hot, but magnetic when cooled. Mr. Darling illustrated the Bastian indicator, which indicated by means of a compass needle when demagnetisation was reached. When steel was inserted into the furnace the needle was deflected, but, when demagnetisation commenced, the needle swung back, reaching its original position on completion. The Wild-Barfield indicator, for use with alternating current, consisting of a moving coil placed between the poles of an electro-magnet, and carrying a pointer moving over a scale, was also described, as well as a detector which gave an audible signal when demagnetisation was complete, the latter being designed by the Hon. C. W. Stopford and the author. The indicator gave very good results, did not need watching, and was suited to either direct or alternating current.

In conclusion, Mr. Darling said that future developments of electrical resistance furnaces in workshop practice would largely depend upon cheap electricity, reliable refractories, and improved heating elements.

Discussion.

The Chairman, referring to the steel which announced that it was demagnetised by ringing a bell, said that manganese steel would not behave in that manner, because if this were heated and cooled it did not change, so that it was important to know the composition of the material. His firm had dealt with no less than 100,000 tons of steel turnings during the war, which otherwise would have been wasted. We should not produce cheap steel electrically, however, until we obtained cheap power: perhaps some day we should get energy at 0.5d. or 0.4d., or less, and then no doubt metallurgical operations would be carried on by electrical energy.

Mr. L. W. Wild said that silica was a very good refractory in furnaces of the sizes used in the laboratory, but was utterly impossible in really large sizes. Comparing the costs of electrical and gas operation, he said there was not the least doubt, with reasonable cost of energy, that the electric furnace, for hardening steel and the like, cost less than gas heating for a similar output. In addition, a still greater saving was generally made in respect of the cost of labour, partly by using unskilled of semi-skilled labour, and partly by obtaining a larger output per man. It was difficult to get comparisons, but when they were obtained they always favoured electricity. As to the upper limit of the resistance of nickel-chromium windings being 1,000 deg. C., for industrial purposes, he agreed, but in special cases, by using wire of the very best quality, by slow heating up and careful nursing generally, one could work the laboratory furnace quite satisfactorily up to 1,200 deg. C. He was glad that Mr. Darling was so hopeful that we should have an alloy to withstand 1,800 deg. C. without oxidising, but the difficulty would be to obtain a refractory to go with it. Unfortunately, the refractory makers' usual method was to take a really refractory powder and stick it together with a small quantity of ordinary fireclay. This resulted in deformation and a refractory made up in that way, if used at a temperature of 1,800 deg. C., would probably attack the alloy. He considered that a refractory which would be required for that work would be something of the nature of a pure alumina or pure zirconia, sintered together at its own natural sintering temperature without any additional bonding material. That, he believed, would come when the wire came. With regard to the use of demagnetisation detectors, the non-magnetic temperature was the right temperature to which any steel should be heated, no matter what the carbon content; it was also the right point for a good many of the alloy steels, but it failed to be of use where the amount of alloy became very large.

Mr. N. Cameron said he had used a Heræus furnace for nearly seven years quite satisfactorily; it had been taken to pieces and re-wound on a number of occasions. The temperature at which this furnace worked was from 950 to 1,000 deg. C., but they could go beyond that by using nichrome wire put straight on to the Heræus tubes. When silica tubes and nichrome were used, however, the silica began to soften, and there was a combination of the nichrome wire with the silica. He had found the round wire very much better than strip, because it was more durable, and if it were possible to use two wires in parallel, it was more satisfactory than using one. An English firm had quoted him £19 for a small furnace; this was exorbitant, and he believed he could build it for about £5 or £6.

Mr. Darling said he had tried to get an alloy made of a definite composition, of aluminium and nickel in atomic proportions. That had the very remarkable property of having a higher melting point than nickel or aluminium; the melting point of the alloy was about 1,600 deg., whereas that of pure nickel was about 1,450 deg. Some time ago he had asked a number of people to make it, and they had promised to send him samples within a week, but he had not yet received them, and concluded that there must be some very great difficulty in making it. With the high-frequency furnace brought out by Dr. Northrup, in America, a temperature of 2,000 deg. had been reached within two or three minutes, but there was difficulty in supplying the high-frequency current.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

President's Address at North-Eastern Centre.—*Abstract.*

The President (Mr. Frank Gill, O.B.E.), attended a meeting of the North-Eastern Centre, at Newcastle-on-Tyne, on January 8th, and delivered an address to the members. Mr. F. G. C. Baldwin presided.

Mr. Gill, before commencing his address, said a few words about the Institution itself. It was the Institution that had the largest number of members; and, that being so, they must realise the responsibility it carried with it. They had nearly got to the point that many persons desired when they talked about registration. Membership of the Institution was not compulsory by law, but it was becoming very desirable and there was no doubt that men who were in a position to judge, in a position to select men, and had a voice in the payment of men, were beginning to attach great importance to the question of qualification. Having regard to the all-pervading character of electrical engineering, if the Institution did its work properly it must grow into a very big concern, and the responsibility for it doing its duty lay on the membership.

Engineers had given a new meaning to the word "economics." Engineering was not merely applied physics, but something more. The engineer had not only to take the facts given by science, but to apply them in the most economical fashion, and the engineer's problem was really to select a method of doing what was required at the least cost or by the least employment of human labour. Specification was an important matter; for two things might be compared in price which were not the same in quality or in service, but it was in this way that they got the true engineering function—that of selection. It was a real engineering problem to find a specification which cost least in the proper

sense. The engineer was vitally concerned with the well-being of his firm, and a good man would alter his method according to the job he had in hand. In this connection annual charts were of importance; annual charges, he said, did not show sufficient detail; they must have details as to time and percentage before they could decide what machine or system they should select. Depreciation was very important and was a question for the engineer, and him alone. The straight line method of calculating depreciation was wrong. The Inland Revenue authorities were inclined to allow as little as possible, so as to show as much profit as was possible, so that they should get as much tax as they could. Only an engineer could assess depreciation, and he could not do it unless he took up the study of economics. Much of the teaching in engineering really concerned apparatus; what was required was a study of systems, and consideration of the whole system involved. Some might ask why engineers should worry about systems. The axiom of the American Federation of Engineers that "service to others is the highest appeal to human nature" might be regarded as one answer; the other was that the right application of economics gave a greater power to purchase. The point was that the more cheaply a thing was made the greater was the number of persons able to purchase it. The British workman seemed to have been taught that there was only a certain amount of work to be done, and that when that labour was finished they would be paid off; therefore, if he did too much it would do his "pal" out of a job. That was a fallacy, although at the bottom there was a generous sentiment. Hard work would assist to bring down prices, make for increased sales, and lead to more work. The facts of economics had to be accumulated by a painfully slow process. There were two special ministers to mankind in a normal state of health—there were the engineers, who ministered to the people's bodily needs (who took the facts which science gave them and applied them to the greatest benefit of mankind) and the artists who ministered to their mental needs. There was no means of evaluating those services, but the human community was not satisfied until at least those two sides of nature were catered for. The work of the engineer was beautiful if it was well done; surely every item of useless cost overcome, and every item of waste eliminated, was some achievement and was worth the effort needed to accomplish it. In that it seemed to him the engineer should find his address.

Mr. C. Turnbull, Mr. W. C. Mountain, and Dr. Thornton spoke very briefly on the subject of the President's address.

DOMESTIC LOAD BUILDING.

Suggestions upon Propaganda.

Discussion at Edinburgh.

Mr. W. A. Gillott's paper on the above subject (which was abstracted in our issue of December 8th, 1922) was read and discussed before the Scottish Centre of the Institution of Electrical Engineers on January 9th, when Mr. A. S. Hampton presided.

Mr. R. B. Mitchell opened the discussion by congratulating the Institution on accepting a paper of this kind—the first commercial paper which the Institution had ever accepted, and one which was so urgently required. The domestic load had a feature of continuity which the industrial load did not possess, and if some undertakings had had a good domestic load to keep them going during the dull times in industry, they would not have felt the effects nearly so much. In Glasgow the domestic appliances connected totalled 17,165 kilowatts, and the consumption of those appliances amounted in one year—last year—to 5,506,000 kWh. They had also in business premises appliances, other than for lighting, totalling 15,080 kilowatts. Propaganda was useless unless one had a tariff to build the load upon. Mr. Gillott's sentence:—"The author inclines to the opinion that the fixed charge should be sufficient to cover a consumer's normal lighting costs when the low-unit charge is added," he agreed with, and thought that the fixed charge should be made stiff to begin with, in order that the running charge might be as low as possible. The drawback to that system of charging was that to the ordinary consumers it was too great a plunge. He had to promise to pay something like £8 10s. before he used any electricity at all, and, particularly in Scotland, the ordinary man would hesitate before he took on such a commitment. But with a tariff which would lead him on in steps in such a way that he never knew how he was getting deeper and deeper into the use of the electric service until he arrived at the stage when one could put forward the above tariff with a fair amount of assurance that he would accept it, then it should be quite easy to prove to him that it would be to his advantage. The running charge must be less than 1d., and he agreed with Mr. Gillott that this fixed charge which he put forward should cover the lighting energy only—perhaps more than that—and that the demand of the heating and cooking appliances should not be taken into account in making up the fixed charge. It had been proved conclusively that the domestic load was nearly always in its entirety an off-peak load. With a fixed charge of something like 10 or 12½ per cent. of the rental and a running charge of ½d., a tremendous development could be made in the domestic load. By taking 10 per cent., plus ½d., and superimposing that on the rate in use in Glasgow, the small user—the man with a rental of, say, £35—with a fixed charge of £3 10s., plus ½d., would be ready to change over to the new system when his consumption reached 900 kWh per annum. Similarly, consumers occupying houses rented at £40, £60, and £70 per annum, would be ready for changing to the new system when their consumptions reached 1,200, 1,400, and 1,700 kWh respectively, with an average price of 1.49d. per kWh. If on the new rate he used, say, 3,000 kWh, the average rate for all electricity used was 1.06d. In Glasgow they had 400 cookers on hire at a rental of £2 per annum, which was less than the 20 per cent. figure put forward by Mr. Gillott. Mr. Mitchell then explained to the meeting a number of curves showing the demand from domestic consumers in residential areas in the city.

Mr. E. Seddon referred to the difficulty of heating water, and thought they might consider thermal storage, and if they could embody in cookers an arrangement for utilising in the morning some of the heat stored during the night, it would be an advantage. The industrial load was now getting a very low rate, and if the domestic load developed at the same rate, they would be getting down to a flat rate all round both for domestic and power loads. The flat rate was the desirable rate if they could adopt it. The curves shown by Mr. Gillott were taken from specially-equipped houses, and the consumption was higher than what might be expected from the ordinary householder. Slot meters might be very nice for the artisan's house, but people in the large residential districts would not take very kindly to them.

Mr. R. Hardie expressed entire agreement with the author. Glasgow had been proceeding generally on the lines laid down, and the results indicated that they were sound. A vast desirable load awaited exploitation, and was obtainable with the minimum of expenditure. The electric cooker alone, in use three times a day all the year round, would convert a non-paying lighting consumer into a profitable one without additional expenditure on feeders, mains, or service cables. It was nothing less than effrontery to canvass the public to use electricity when the canvasser was himself using other methods, and the way should be made very easy for every employé of an electricity supply undertaking to live in a wired house and gain the first-hand experience which would enable him to spread the gospel. The advertising value of this would be far reaching. Another branch of propaganda urged by the author, the "Electric Home" exhibit, was deserving of more general adoption.

Mr. A. Mears urged, at any rate for the start, simplicity of tariffs. In future one might quote a high-standing charge per kilowatt and a low-running charge when devices such as thermal storage were in use, but with only the ordinary heater a satisfactory flat rate, which the consumer would understand better, would more likely lead to good business. In Edinburgh consumers in good-class property never objected to putting in the two-meter second circuit. The heating load would only increase considerably when cookers were hired out. The author stated the number of kWh per annum per kilowatt installed to be 360 for 65 kilowatts installed, which gave 23,400 kWh, but 23,400 kWh with 19 kilowatts of maximum demand gave a load factor of some 14 per cent.—which, so far, was far too low. The sum of the maximum demand of consumers divided by the maximum demand on the station should give a figure near 2½ or 3, but the author mentioned a figure of 9.

Prof. F. G. Baily thought that before consumers could be expected to adopt electricity to any considerable extent in the household, they ought to be allowed to test its merits, and it ought to be possible to install the apparatus in some temporary way, so that the wiring and fixtures could be removed without difficulty in the event of the consumer's being dissatisfied with the appliances. So far as the heating of rooms and the provision of hot water was concerned, the most satisfactory way of performing these services was by a central heating system in conjunction with electric radiators.

Mr. W. J. Cooper could not understand the attitude of business men towards the two-part system of charging. No one knew better than business men what on-cost charges were, yet when an electricity supply authority proposed to charge for its product on the basis of an on-cost charge, plus a charge per kWh used, there was difficulty in getting them to appre-

ciate the system. He had overcome the objections to a certain extent by expressing the standing charges in banks of kWh, something on the lines of the Glasgow domestic heating tariff.

The Chairman (Mr. A. S. Hampton) asked Mr. W. A. Gillott to reply to the discussion through the *Journal*. A tariff based on a charge of so much per room, plus a running charge per kWh used, would only necessitate one meter, a very low rate per kWh, and everyone would understand it; it was practically the same as the Glasgow Corporation rate.

Discussion at Leeds.

Mr. W. A. Gillott's paper was read and discussed before the North-Midland Centre of the Institution of Electrical Engineers, when Mr. W. B. Woodhouse presided over a good attendance.

Mr. P. Furness opened the discussion. He said that in one of their districts where a number of consumers had adopted the residential or two-part tariff, the news had spread so rapidly that they had got 50 per cent. of the domestic consumers on that rate at the present time. There were a lot of cases where people were desirous at the present time of putting in all classes of heating and cooking apparatus, and would do so provided they could get cheap hire purchase.

Mr. H. G. Fraser (Wakefield) thought the chief drawback to the development of domestic electricity in the West Riding of Yorkshire, was the difficulty in getting Yorkshiremen to buy the necessary apparatus. There was a good deal of difficulty in selling a large amount of electricity at 1½d. per kWh. Many municipal authorities had no selling and no wiring powers, and they would have great difficulty in selling electricity for cooking purposes unless they had a good hire-purchase system and had full powers to rig the apparatus up and help the consumer all the way through.

Mr. Gamlen considered that one of the chief questions people would ask in a new district was: "How does it compare with gas?" In some places consumers could obtain a gas cooker free if they would use gas; when such consumers found they would be charged for an electric cooker they were not exactly pleased. People had extraordinary ideas of the expense of electricity. One perhaps could not blame them, because they had always been told it was expensive. Articles in the newspapers explaining various points would be good. Suggestions for lighting might be made, where to put the lights, and the best kind of lights. In the showroom it was a good plan to have a meter that registered the pence per hour, so that people could see what a device was going to cost them.

Mr. Toppin (Bradford) thought that there should be one electrical exhibition at least every year, consisting of every new electrical appliance, ovens, water heater, &c. Such exhibitions would allow manufacturers to get more in touch with users of the apparatus they sold, and they could thus rectify mistakes which they had made in designing.

Mr. Jones (Bradford) said that he often thought a great deal too much stress was laid on the price rather than on prejudice. His experience taught him that ladies were essentially conservative, especially in house matters. In electrical matters it was often the husbands who had to persuade the ladies. He had come across cases where electricity was available for domestic use, but it was not used because of prejudice. Would it not be possible for companies or syndicates to actually install electrical appliances in various houses free of charge, without any liability on the part of the occupiers, for a year's trial—of course, following the installations up and seeing that they were used? His experience of salesmanship taught him that sales were not effected very often at the first effort. If the housewife had the opportunity of using the apparatus the neighbours would talk about the methods, and that was when the sales were effected.

The Chairman (Mr. W. B. Woodhouse)) pointed out that Mr. Gillott's figures for the village of Billingham gave a demand of 65 kW for 25 houses. If they took four persons per house, that was roughly ¾ kW per person, and in most of their industrial districts the power demand varied between ¼ to ½ kW per person; therefore, if Mr. Gillott's figures might be taken as representative, there was a very much bigger field, domestically, than there was in the power supply business, and it was a very much more secure field. It seemed absolutely necessary that the supply authorities should, as far as possible, get the two-part tariff adopted, and make a special effort to get people to use it. Really the difficulty now was largely the first cost.

In replying to the discussion, Mr. W. A. Gillott remarked that the cost of the installation would be returned in services rendered within four years. If they asked a man to invest money on a 25 per cent. basis he would jump at it. If it was put to persons in that manner he felt that they would see the force of the argument. Electric cookers or fires should be hired or obtained on the hire-purchase system—hired in preference; without a doubt the hiring of cookers was a commercial proposition. If they took his basis of 20 per cent. on the net cost, after they had paid their maintenance cost there was a return of 11 per cent. on the capital invested, plus the profit on the electricity consumed, which would not be consumed if those cookers were not installed. No supply undertaking which took the privilege of giving a public supply should overlook the fact that it was its bounden duty to give the consumer *service*. Unless they followed up the domestic service in the manner in which it should be followed up, they would not get satisfactory results. One of the first things they should do ought to be to employ a lady versed in home arts. He was firmly convinced that it was desirable to have a two-part tariff, although the paper suggested a one-part tariff. The residential curve was identical with some of the curves he had shown them. At the time of the evening meal it did rise a little, but it was a very small increase that would not affect their system peak. One of London's West End engineers, where everybody went in for evening meals, did not know the evening cooking peak was on. That was due to the fact that a man could not be in his office and be on his way home, or at home, at the same time. In a small residential village it was probable that the cooking or heating load was likely to cause them a little anxiety from a cable point of view, but he did not think the difficulty was anything like as big as many of them anticipated. It might be cheap to cook at 6d. per kWh; it depended what the coal and gas figures were. If they took an average of 1½d. per kWh, he was of opinion that a lot of business could be secured; 1½d. per kWh was equivalent to gas for cooking at 3s. 9d. per thousand ft., or about 10½d. a therm. So on fuel cost alone they were not up against a serious proposition. The only way to educate consumers was to give them a practical method of trying things. The average maximum demand per consumer on the Billingham estate varied from four to five kW. Each house was wired on the assumption that the demand would be 60 per cent. of the total load installed. It was found that that demand was almost rigid; the charts showed that the average amount owing to the diversity factor was only a little over 1 kW.

SUPER-POWER STATIONS.

A Joint Discussion by Civil, Mechanical, and Electrical Engineers.

A joint meeting of the Midland Branch of the Institution of Mechanical Engineers, of the Birmingham and District Association of the Institution of Civil Engineers, and of the South Midland Centre of the Institution of Electrical Engineers, was held at Birmingham on January 25th, 1923, to discuss "The Advisability of Limiting to Super Power Stations the Public Supply of Electricty."

The chair was occupied by Mr. Loughnan St. L. Pendred (member of the Council of the Institution of Mechanical Engineers), who was supported by Major S. J. Thompson, D.S.O., (chairman of the committee of the local branch of the Institution of Mechanical Engineers), Mr. J. E. Swindlehurst (president of the Birmingham branch of the Institution of Civil Engineers), and Prof. W. Cramp, D.Sc., M.I.E.E. (of the University of Birmingham, and chairman of the South Midland Centre of the Institution of Electrical Engineers).

About 300 members of the three societies and visitors attended the meeting.

Sir Vincent L. Raven, K.B.E., speaking as a railway engineer, felt certain that unless electricity could be produced at a cheaper average rate than it was to-day many prospective users, who were fully convinced that this form of energy was in every way economical from many points of view, would be prevented from employing it. That certainly held good with regard to railway traction. He felt sufficiently confident of the future to definitely state that power supply at a price not exceeding ½d. per kWh could be regarded as imminent. Super power stations, if the idea was a limited number of stations at suitable places distributing through main trunk lines, were admittedly impossible owing to the enormous capital outlay—and the difficulty of carrying main cables through many parts where special conditions, costly in themselves, would be imposed. Stations with from at least fifteen to twenty thousand kW of turbo-generator plant should be erected in carefully-selected positions, and an essential object was that the plant should produce electricity with not more than 2 lb. of coal per kWh—this could be done. He did not favour generating power for individual undertakings, even for so large a user as a railway company.

With a limited number of stations the cost of transmission would be too high; separate stations should be encouraged in large industrial areas and the smaller units should eventually be abolished, as the time had arrived—if the coal in this country was to be conserved—when economical measures must

be adopted (and enforced by Government legislation if necessary), so that economical, adaptable, and useful power was made the utmost use of.

No real advance was possible until the supply authorities had set their own houses in order, and at whatever sacrifice of individual and local susceptibilities this must be done.

The simplest and most satisfactory way was, no doubt, that followed on the North-East Coast, where a well-managed company was in the saddle, but whether through the instrumentality of private enterprise, a Joint Electricity Authority, or an Advisory Board, the control and use of all generating stations and main transmission lines in an Electricity District must be centralised if real progress in industrial matters was to be assured.

"Capital" stations were required in an increasing number.

The cost of main transmission lines should be covered by the economies effected in connection with spare plant and improved running conditions. At the same time, a number of stations must remain isolated and complete articulation with the common system in these cases must be regarded as impracticable at present.

It cannot be too strongly contended that the policy of anticipating needs was essential to the full development of electricity supply. While there was no case for the complete transference of existing loads to "capital" stations these stations were the main factor in the common system from which all users would draw their supply if a thoroughly progressive policy was encouraged and followed.

Mr. Alfred Dickinson suggested that super stations should be permitted to supply energy, not only in any district, but to any consumer willing to take it. To those interested in existing undertakings that view might not appeal, but if the best all-round results were to be obtained, should not the supply and sale of electrical energy be as free as the sale of any commercial or manufactured commodity?

In the near future coal would not be used for steam generation in the way it had been used in the past; it would be distilled, or treated in some way, to get therefrom many products which could be sold, and low-grade gas would be produced as a by-product available for steam generation, or utilisation for power production in some way. Could such an undertaking not supply energy at a cost below that of a super-station producing power by present methods, and should an undertaking of the character indicated not be permitted to dispose of cheap power in competition with super, or any other existing station? Legislation and onerous regulations had, in the past, greatly retarded development, and care should be taken not to repeat the mistake. The abolition of parochial boundaries was essential.

In the best interests of advancement should monopolies exist? And had they reached that stage when all industries could rely upon their merits for existence?

In the near future electrical energy would be manufactured more as a by-product than a main product; but its sale and use must be on strict commercial principles. If super-stations were to have a fair chance with undertakings owned and worked by municipalities, municipal stations should not enter into unfair competition by selling energy to any consumer at a rate which was not fixed on strict commercial principles. Personally, he felt very strongly that if the electrical industry was to advance they must get away from all old-fashioned notions that something that was new would kill something that was old. If anything had got so old that it had become decrepit, then the sooner it was killed the better.

Mr. R. A. Chattock said that the subject under discussion was one he could not endorse unreservedly. A comprehensive scheme of that kind would undoubtedly cheapen the cost of production and consequently the price that the consumer would have to pay. Developments must go on upon sound financial and engineering lines, utilising the older generating stations to meet the intermittent or peak load demand, which was only felt for a few hours a day, and carrying the bulk of the supply throughout each 24 hours on the more modern stations in which the highest economy could be obtained, at the same time utilising all sources of waste heat and water power available where these could be proved to be beneficial. Such an arrangement could be applied to districts much larger than those that have been generally operated in the past, and to justify the above conclusions he had prepared figures giving the average results obtained in existing generating stations of various descriptions, which showed that the larger the undertaking the cheaper could electricity be produced, and that when the cost of transmission and distribution was included the large undertaking could still easily beat the small station.

The examples included the older less economical stations, as well as the modern stations, and in order to compare those results with those obtained from a super station he included the figures that it was estimated would be obtained from the Nechells station of the Birmingham Corporation when completed. In spite of the somewhat heavy capital expenditure on this station, the cost per kWh generated, including all capital charges, only worked out at about one-third the present average cost of the three undertakings in the former group. In spite of this, however, it would not pay to at once scrap all the older stations of the undertaking; they should be retained to meet the short-hour peak loads until their capital value was automatically written off and they were worn out. To this extent, therefore, the limiting of the public supply of electricity to super-power stations was not immediately justified, though as time went on the smaller stations would gradually disappear, which result would be automatically achieved.

Lieut.-Col. E. Kitson Clark pointed out that a half-million tons output colliery would, out of the coal which it was economical to use for the purpose of generating electricity, provide for a 100,000-kilowatt station. The real break in costs came below the 50,000-kilowatts line. He, as a mechanical engineer, had come to the conclusion that at present the large generating unit was best considered in terms of 50,000 kilowatts. Five kilowatts of generating plant and three of steam-raising plant could be accommodated per square foot of ground. That proportion was very significant, as under present circumstances they would have to have coal mines of enormous size if they were going to supply the coal which they could economically use in producing steam for generating electricity; it would be very difficult to find a mine that could do this on a very large scale and, therefore, they would have to transport coal. On the North-Eastern Railway (experts in the transport of coal) the actual distance would not so much matter; therefore one of the reasons for locating their generating power at or near the pit head fell to the ground at once until they were provided with a far better system of getting their steam power. He was told that in the large generating stations switches had to be very much more complicated, and that the present practice was to duplicate the units. If that were so there was every reason for getting their electricity made where they could make it best, and supplying it all into the common stock. The resolution before the meeting (if it was a resolution) admitted that they would have to have a central controlling authority. Large stations would undoubtedly produce the cheapest electricity, but one's experience of electrical engineers was that their fertility was enormous; that by the time they had got one set of machinery into action something better had already come to light. In Leeds they had come to the direct conclusion that, for the present, at any rate, it would be very unwise to crowd all their money into a super-station.

Mr. J. H. T. Legge observed that electricity for industrial purposes must be cheaper, but, generally speaking, people got very good value in electricity for lighting purposes. Under the auspices of the Commissioners people were beginning really to take courage (particularly his municipal friends) and to think possibly there might be something in generating electricity on a big scale outside their areas. The generating cost in small stations when the industrial load was added, say, for 50 or 60 hours per week, undoubtedly was very good; but for the remaining hours of the working week their costs amounted to three, and sometimes four, times the average cost. To cheapen electricity they must lower capital charges in addition to generating costs, and capital stations to take over the load when the smaller stations could not generate at the cheap figure were coming about gradually. A very large number of persons were not yet convinced of the desirability of placing the control of electricity under one body. The old idea of big stations at the pit-head was a bubble that burst long ago, for the reason (stated by the previous speaker) that they could not find collieries capable of supplying the requisite fuel, while, should there be trouble arising from strikes, fires, &c., it would be difficult to find other supplies of coal.

In connection with wayleaves, the Postmaster-General was in undisputed possession above and below the earth. He had hindered the distribution of electricity in rural districts more than anything else.

Sir Henry Fowler said that the questions involved related much more to finance than to engineering. They had been told what the price of electricity from a super-station might ultimately be "at the door," but in the majority of cases they were not going to use it at the door. That was the point that would settle the economical standpoint—he would not say the actual standpoint. It was wholly a question of economics and individual circumstances.

Mr. S. T. Allen suggested that neither an affirmative nor a negative reply could be given. If the proposal were that super-stations should apply to the whole country, the answer would be "No." It was necessary to consider national resources, including water power, to say nothing of waste heat. The data at present available would not permit of a definite reply. Again, if the country were divided into districts, the answer might be either "Yes" or "No." So much depended upon the circumstances of the case; one station might be the most suitable for one district, and a group of small stations for another. A very wrong impression would be given if it were thought, as had been suggested, that municipal authorities did not write down their plant in relation to their electrical undertakings. They had to do it in a more definite way than companies were required to do it. The question depended upon comparative conditions, circumstances, and degree, having regard always to the way in which interests (quite dissimilar) were served.

Major A. M. Taylor spoke about the cost of transmitting power by underground cables as against that of the carriage of the coal to the generating station. The cartage of coal, based upon the use of 2.75 lb. per kWh (it did not always pay to take the most expensive coal, and therefore the above figure was probably a safe average one) was taken as the basis, and

railway carriage at 1.2d. per ton-mile (0.044d. per kWh generated per 30 miles). In his recent I.E.E. paper it was shown that, by using 100,000 volts, 50,000 kW could be transmitted over 30 miles at an initial outlay, on account of cables only of £0.266 per kW per mile. By stiffening the copper 100,000 kW could be transmitted over the same six cables at a cost of £0.17 per kW per mile. At least one firm of cable makers was prepared to make cables to work at a maximum potential gradient of 50,000 volts per cm., which would permit the voltage of transmission to be raised to 150,000, and enable 200,000 kW to be transmitted over the same six cables, three of which he proposed should be run along one side of a railway line and three along the other side. Under those conditions interference with Post Office wires would be virtually eliminated. This increased power would bring down the capital outlay to £0.085 per kW per mile, and interest and sinking fund charges at 10 per cent. worked out *for the whole* 30 *miles* under those conditions to only 0.018d. per kWh—the figure which would have to be added to Mr. Chattock's 0.44d. on account of capital outlay alone. The cost of the loss of energy in the line and in the step-up and step-down transformers would add (taking power at 0.50d.) a charge of 0.025d. to the above 0.018d., making a total of 0.043d. per kWh, as compared with 0.044d. with direct coal cartage. The cost of special coal sidings at the receiving station and coal storage and distribution, also the removal of ashes (all of which were high in the neighbourhood of a large town) had not been taken account of.

Prof. Cramp asked if, assuming a super-station in a district, as well as one or a group of collieries with a certain amount of slack, not worth more than 5s. or 6s. per ton as it lay, it were possible for the super-station to supply energy to those collieries at the same price as that at which they could generate it for themselves. If they could, well and good; let them do it. But if they could not there should be no monopoly; since monopolies had a habit of showing tyranny, it was absolutely necessary that individually they should insist upon having independence beyond that point. If the proposal were to limit the public supply of electricity to super-stations, then his answer was—certainly not. Under certain conditions a station might be able to develop power, in a small radius, as well as a large station some distance away. Such distances had arisen in the case of oil engines in small stations. It was a matter of finance, and if it would not pay the consumer to take power from the super-station he should not be compelled to.

Mr. J. C. Vawdrey said that with the coming of the super-station they would find their natural position. Manufacturing concerns reached a certain point beyond which it became uneconomical to extend, and power stations would be limited by the districts which they had to serve, and by certain economical bounds, those special areas being limited to manufacturing districts which could utilise the electricity. There were some parts of the country, like Cornwall and Devon, which obviously could not make a paying return on the capital outlay on a power station of any size.

Mr. Selby asked why everyone was so keen to get the electrical engineer to do what he was very anxious to do for himself, if he was allowed to? The task for civil engineers was to try to remove those obstacles which had been placed in the path of the electrical engineer by law and finance.

Sir Henry Fowler suggested that the accountants' part of the matter was what the electrical engineer was now fighting against, as also against legal opposition. A financial man examining a proposition would always cut out any hopes of the future, however good they might be, in favour of an immediate financial return on his outlay, and that perforce was the line the electrical engineer must work upon, unless some form of Government monopoly came about; therefore, there were many advocates of the latter course. There was no monopoly, and there never could be. It was an open question whether the powers which had been given had at all compensated for the onerous duties laid upon certain undertakings. On the whole the development had been very good, but very slow. At the present moment it was very rapid.

Prof. Lea remarked that to the question in the way it was given on the agenda paper he would give a negative reply. He did not think it meant what it said. By the hydrogenation of coal, by tapping crude oil sources within certain limits, and with certain types of internal-combustion engines, there might be possibilities of producing power in the future with a consumption of perhaps 1 lb. or even less of coal per kWh. If it was possible, and if they concentrated too much on the large super-station, they might run a risk of escaping the possibility of development which would only take place probably in smaller stations, and proceed from the small to the large unit. They must not overlook the fact that there were possibilities of generating power from their water resources. He was more optimistic with regard to that question than were many of his friends. Any limitation of public supply to super power stations would imperil future developments in the electrical industry.

The Chairman, in closing the discussion, said that there must be no monopoly. Sir Henry Fowler had told them it was an economic question, and not a question for engineers at all. There he frankly disagreed with him. It was their first business to be good engineers; they had to reduce coal consumption and increase the efficiency of their plant. Afterwards, as a secondary matter, economics would come in. The highest economy was not always, of necessity, the best policy; other reasons, altogether apart from the mere economy of generation, might have to be considered. Sir Vincent Raven had spoken about the planning of coal supplies. The Electricity Commissioners had already divided Scotland into five districts and England and Wales into 22, in place of the rather awkward divisions they had to employ last year under the original divisions of the coal controllers. It was an extraordinary fact that the smallest stations of all had the lowest coal consumption. They had concentrated on coal consumption when they ought to have thought of thermal efficiency. Although the Electricity Commissioners anticipated no considerable improvement in the efficiency of the best stations, they did believe—and it was a very important point—that there would be a considerable increase of efficiency in the medium stations.

Mr. A. C. Pain (communicated) pointed out that it was absurd to burn huge quantities of coal, and then to erect enormous cooling towers to dissipate uselessly 60 per cent. of the heat units generated. Surely some better system must be found eventually, and in the meantime the most likely way to perpetuate or prolong such a system was to give a monopoly to the super power stations. Such stations, if they were to supply small quantities of electricity, should also be required to receive small quantities of electricity from anyone who could generate more cheaply.

THE BRITISH INDUSTRIES FAIR.

London and Birmingham.

The ninth British Industries Fair opens simultaneously at the White City, London, and the Castle Bromwich Aerodrome, Birmingham, on Monday next. The utility and popularity of this annual event increases from year to year, and the term "Britain's shop-window," once applied to it, is certainly apposite. As in previous years, the London section, which is under the direct control of the Department of Overseas Trade, will consist for the most part of the lighter products of British firms. The Birmingham section, under the *ægis* of the Birmingham Chamber of Commerce, is likely to prove of greater interest to most of our readers, as it is there that the more substantial engineering products will be on view. Between them the two shows cover practically the whole of British industry, saving only textiles which, up to 1921, were separately exhibited, but eventually dropped.

Invitations to visit the Fair have been sent to a quarter of a million trade buyers in the United Kingdom, and to 50,000 buyers overseas. All exhibitors are actual manufacturers, a circumstance which prevents a great deal of confusion and waste of time owing to the same goods being shown in different places.

We have received an advance copy of the catalogue of the White City section, and from this we have extracted the names of firms displaying electrical goods or articles of use to the electrical industry. From Birmingham a preliminary list of exhibitors has been obtained, but we believe this to be incomplete.

The following firms are exhibiting:—

London.

G. C. Aimer. X-ray tubes, high-frequency apparatus, and radio apparatus.
Cinema Traders, Ltd. Projectors, optical lanterns, &c.
Will Day, Ltd. Kinema projectors.
Alfred Dunhill. "Lytup" ladies' handbags.
Electric Gramophones, Ltd. Electric gramophones, &c.
The Ever-Ready Co. (Great Britain), Ltd. Portable electric lamps, dry batteries, &c.
Gillett & Johnston. Electric clocks.
Hopkin & Williams, Ltd. Chemicals for electrical purposes.
The Horstmann Gear Co., Ltd. Time switches, &c.
Meccano, Ltd. Electrical toys, radio-telephony apparatus, &c.
Ernest F. Moy. Arc lamps, and kinematograph apparatus.
Omnia Kine Apparatus Co., Ltd. Kinematograph apparatus.
Ross, Ltd. Kinematograph projectors, &c.
Synchronome Co., Ltd. Electric clocks.

Birmingham.

Accles & Shelvoke, Ltd.
Ackroyd & Best, Ltd.
Automatic & Electric Furnaces, Ltd. Furnaces for the heat treatment of steel, &c.
Batteries, Ltd.
Bell's United Asbestos Co., Ltd.
Britannia Tube Co., Ltd.
British Electrical Repairs, Ltd. Examples of repaired electrical machines.
British Engine Boiler & Electrical Insurance Co., Ltd.
British Mannesman Tube Co., Ltd.
Cable Accessories Co., Ltd. "Revo" appliances, electric lighting fittings, &c.

W. Canning & Co., Ltd. Electro-plating apparatus and chemicals.
Cape Asbestos Co., Ltd.
Carron Company. Electric cookers, grills, &c.
Clayton Wagons, Ltd.
Clear Hooters, Ltd. Electric horns, &c.
Continuous Reaction Co., Ltd.
Coventry Electrical & Engineering Co.
The "Daisy" Vacuum Cleaner Co., Ltd.
The Delta Metal Co., Ltd.
Ebonestos Insulators, Ltd.
Edison Accumulators, Ltd. "All-steel" accumulators.
Edison Swan Electric Co., Ltd. Lamps, radio valves, electric fires, lighting fittings, &c.
Feed Water Specialists Co.
Fielding & Platt, Ltd.
Firth-Brearley Stainless Steel Syndicate, Ltd.
Holt & Willetts. Cranes, hoists, &c.
Kelvin, Bottomley & Baird, Ltd.
John Kirkaldy, Ltd.
Newton Bros. (Derby), Ltd. A.c. and d.c. motors, h.p., d.c. generators, patent reversing drive, &c.
Park Royal Engineering Works, Ltd. Truck-type cubical switchgear.
C. H. Parsons, Ltd.
G. D. Peters & Co., Ltd. Electric welding plant, industrial electric trucks, &c.
Premier Electric Heaters, Ltd. Domestic heating and cooking appliances, &c.
Railway Signal Co., Ltd.
The Rawlplug Co., Ltd.
The Selson Engineering Co., Ltd.
The Steam Gauge Manufacturing Co.
Superheat Furnace Co., Ltd.
Sutcliffe (of Crumpsall), Ltd. Vulcanised fibre.
Tangent Tool Engineering Co., Ltd.
John Thompson, Ltd., Wolverhampton.
Tubes, Ltd.
J. H. Tucker & Co., Ltd. Ironclad, &c., switch and fuse-gear, tumbler switches, and accessories.
Venner Time Switches, Ltd. Time switches, current limiters, &c.
Mark Webber, Ltd. Oil engines, &c.

THE VAUXHALL MOTOR-CONTROL PILLAR.

A New E.A.C. Product.

The varied products of the several works of the Electrical Apparatus Co., Ltd. (incorporating Messrs. Bray, Markham and Reiss, Ltd.), need no introduction; and the new apparatus which we have from time to time described bears witness to the fact that no relaxation of the continuous effort to improve upon what has already been achieved is permitted. It occasioned no surprise, therefore, when we were recently given the opportunity of inspecting still another piece of new switchgear that has been produced, which possesses several features worthy of note.

It takes the form of a floor-fixing pillar-type motor-control panel, of which the accompanying illustrations show several different views; in this have been incorporated the good points of similar gear manufactured by both the above-named organisations. One of its chief features is accessibility; no matter how cramped the position in which the pillar may be installed, every part of it is easily get-at-able and, even should it not be possible to open the rear door, the whole of the panel can be withdrawn from its housing through the front door. As is shown by one of the illustrations, fig. 4, the resistance grids are hinged so that each may be lifted and inspected without any obstruction from the others, and the component parts of the pillar can be taken to pieces and re-assembled in a short space of time, as we had an opportunity of witnessing. The panel presents a pleasing appearance, and its overall dimensions cannot be taken exception to.

The "Vauxhall" pillar consists of a sheet-steel housing with a cast-iron crown and base, hinged doors at the back and front, and external operating handles. Each panel contains a drum-type isolating switch and two single-pole magnetically-operated circuit breakers (contactors). The latter are fitted with no-voltage and overload release devices in each pole, and are fully interlocked with and actuated by the handle of a "Vauxhall" starter provided with roller contacts and one-minute rated resistance consisting of either B.M.R. enamelled steel-tube elements or "unbreakable" grids; the resistance material is in all cases non-corrodible.

The starter embodies the well-known E.A.C. "inching" feature which ensures that all current breaking is done on the contactors and never on the starter contacts. The overload release is operative at all times, and the combination of starter and contactors provides all the advantages of a loose-handle

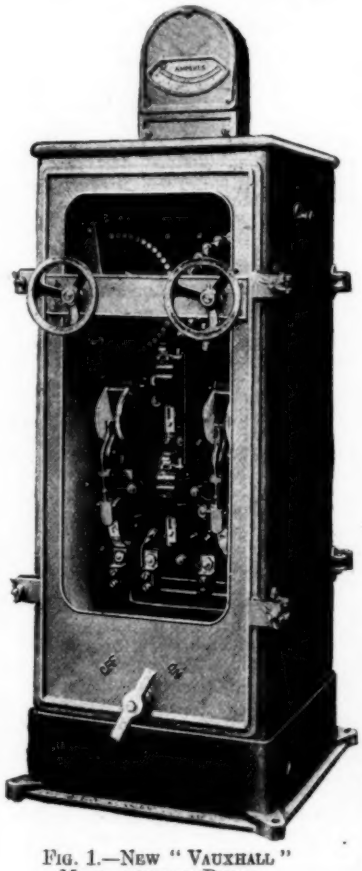


Fig. 1.—New "Vauxhall" Motor-control Pillar.

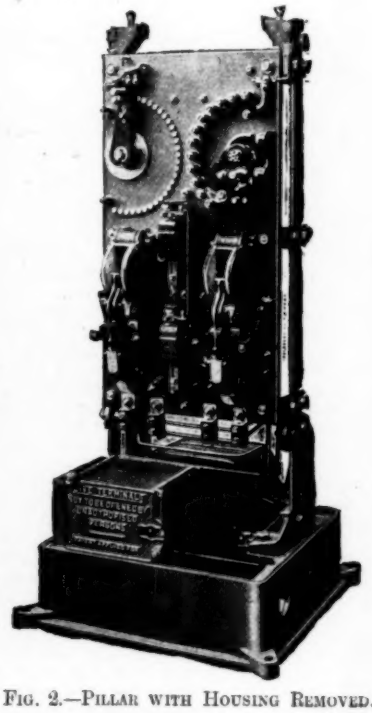


Fig. 2.—Pillar with Housing Removed.

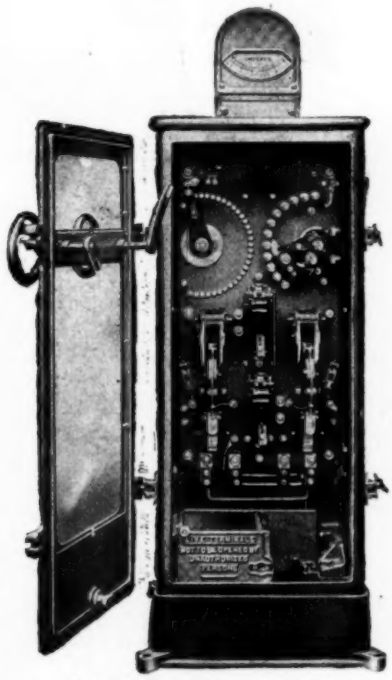


Fig. 3.—Front View of Pillar.

circuit breaker; moreover, there is only one operating hand-wheel.

A shunt regulator is fitted when the pillar is to control a variable-speed machine: it is interlocked with the circuit breaker so as to ensure that the motor will start with full field strength, the interlock being of such a character as to obviate the possibility of a high back e.m.f. being generated when shutting down. A push button is located on the side of the pillar for stopping purposes; in addition, the motor may be stopped at any time by turning the isolating key (shown at the bottom of fig. 1) to the "off" position, or by moving the starting hand wheel backwards. In any event the circuit is broken by the contactors. Besides all the necessary inter-connectors and cable sockets, terminals are provided for the use of distant "stop" and "inching" buttons if they are required.

The isolating switch is mechanically interlocked with the front and rear doors so that the latter cannot be opened whilst the isolating switch is in the "on" position and, conversely,

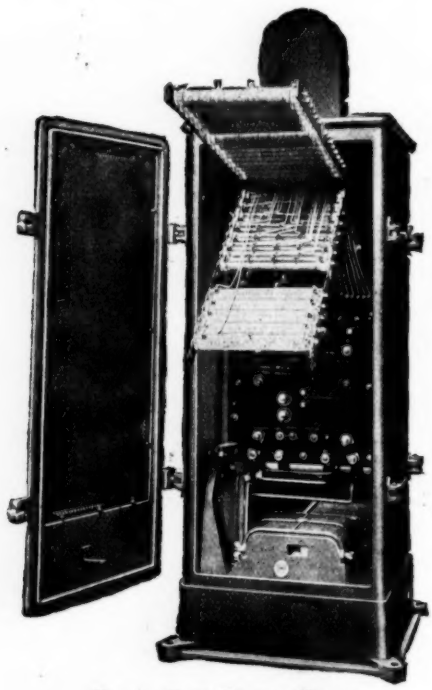


Fig. 4.—Rear View of Pillar.

the isolating switch cannot be closed while either door is open. The isolating switch and the two supply terminals are enclosed in ironclad compartments so that there is no possibility of a shock being obtained during the process of inspection. Both the front and back doors are very large, and give good access to all internal fittings. The frames carrying the resistance tubes are hinged to facilitate the replacement of any damaged tubes, whilst the complete slate with its fittings can be removed through the front opening by undoing the slate fixing bolts and the connections at the bottom of the slate. The housing is removable by undoing two crown bolts, and this leaves the interior intact, as no part of it is carried on the housing.

For industrial use the front door is glazed, while for mining and for marine work (if specified) sheet steel is fitted in place of glass. The robustness and good workmanship characteristic of all E.A.C. apparatus are not lacking in the new product

REVIEWS.

The Electro-Metallurgy of Steel. By Colin C. Gow, B.Sc. (Eng.), Assoc.R.S.M., M.I.M.M. Pp. xvi+351; figs. 132. London: Constable & Co., Ltd. Price 27s. 6d. net.

This book forms one of the sections of the Treatise on Electro-Chemistry planned and edited by the late Bertram Blount, and we may say at once that on the whole it is the most complete work on the subject at present available in English. The author is a metallurgist of wide experience and of high scientific attainments, and as a consequence the subject is treated throughout in a thoroughly systematic fashion. Many writers seem to forget that an electric furnace is essentially a furnace, and not an appliance for the utilisation of electrical energy, important though that aspect of the matter may be. Mr. Gow keeps to the fore the metallurgy of electric furnace practice, and the best sections in the book—they form the greater part of it—are those dealing with general metallurgical principles as applied in furnaces which are heated electrically. Compared with this, descriptions of types of furnaces are comparatively unimportant, while the futile attempt often made to teach electrical engineering by the way is carefully avoided by the authors. None the less, the purely electrical side of the subject is not neglected, and while the fundamental ideas with which the user of the electric furnace will have to be conversant are given in the form of a chapter of electrical definitions, the general principles and applications of alternating current are also briefly described and presented in a manner that will be readily comprehensible to those without special knowledge. This "little knowledge" is essential when the metallurgist has to discuss with the electrical engineer problems of power consumption and control that are inseparable from the metallurgical aspects of the subject.

The essential idea underlying the electric furnace is that electrical heating enables chemical reactions to proceed in an atmosphere uncontaminated with oxidising gases and under slags of special character—operations impossible in gas or other types of furnace. Hence the supreme value of the electric furnace as a refining agent. But the efficacy of the refining process depends largely on the high temperature of the metal and slag, and the attainment of high temperatures and the ease of temperature-control possible in an electric furnace are almost as important a feature as its freedom from oxidising and contaminating gases. The conditions that determine the temperature and its control are partly mechanical, partly thermal, partly electrical, and partly chemical. The last of these depends on the reduction and refining processes that take place, while the thermal conditions depend on furnace design and the refractory and other materials used in construction. Mr. Gow deals fully with both of these subjects, and if his treatment of mechanical regulation and electrical control is less complete, it is because he is addressing the metallurgist in the first instance.

Electrical engineers have, perhaps, been too slow in coming forward to assist the electro-metallurgist to solve his special problems. We think that a careful study of this book will help them to appreciate his needs and to see possibilities for a considerable extension of electricity supply. In no less degree it will help the steel metallurgist to make use of a mode of operation invaluable for special purposes, such as the melting of scrap and the manufacture of highly-refined steel and of the ferro-alloys now so greatly used, and yet also capable of very extended general application and development.

Dynamo Design and Construction. By A. H. Avery, A.M.I.E.E. Pp. iii+264; figs. 406. London: Cassell and Co., Ltd. Price 6s. net.

Here we have a book dealing with the small dynamo. Experienced designers find that it is by no means easy to predict the performance of a tiny dynamo or motor as accurately as that of a large machine, due to the preponderating influence of secondary effects in small machines. Fortunately the issues at stake are not so great in the former as in the latter case, but it is nevertheless desirable to know how to calculate the parts even of a model machine.

The author really gets to work in Chapter III on types of armatures, and in Chapter IV on types of field magnets, and shows his close acquaintanceship with his subject. It is somewhat misleading, however, to say that "interpoles are there for the correction of flux distortion due to armature interference with the main field." Then comes a chapter on bearing brackets, end shields, and frames, in which different types of motors are illustrated. Much useful information is given on bearings, commutators, brush holders, &c., though it is strange to read that self-aligning bearings are largely used in cheap motors of fractional horse-powers. Are they not also used in larger motors?

After an excellent mechanical treatment we come to the electrical part. The output coefficient is introduced, but the author has got his mathematics rather mixed up on p. 76. The discussion on design is illustrated by the complete design of a dynamo for ¼ kW at 100 volts. Everything is here explained with such detail that however ignorant a keen reader may be at the outset it is hard to see how he can err. Even with this the author is not satisfied, and he adds a long chapter on armature connections. Then follows much useful information on insulating materials and testing. Theory is briefly touched upon in a chapter on commutation and armature reaction. The complete details and drawings of a 100-watt machine are then given, while the last chapter is devoted to motor-generators.

Altogether we find this a good book; indeed, we do not know of a better book on very small machines. Though there are doubtless some points about which caution is needed we have seen nothing that would lead astray a reader who thought about what he was reading. There are many worse ways in which the amateur might spend 6s.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Flash-o-Lite" Adaptor.

In our issue of November 24th, 1921 (p. 810), we described a lampholder-adaptor which, by means of a thermostatic device, switched an electric lamp "on" and "off" for regular periods, making it suitable for application to flashing signs. The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has produced a similar article, which, however, possesses the distinctive feature of adjustment of the flashing period by a small screw. The contacts are of platinum silver which will withstand a great deal of hard usage.

The "Bungalow" Fire.

The Arora Co., of Loughborough, has recently put on the market the "Bungalow" fire, illustrated in fig. 1. This is of simple design, consisting of two end castings and a sheet-iron or aluminium shell. Into this shell the element mounted on a wrought-iron strap is fitted, being held by three screws; one through each of the end castings, and one in the centre of the back. Two insulated pin terminals project through

Fig. 1.—The "Bungalow" Fire.

the back, and to these are fitted insulated plugs. The front of the shell is protected by a wire guard, and a wire handle is provided. The element can be of either 750 or 1,000 W. The fire is 11¼ in. high, 11 in. wide, and 7 in. at base, and its weight is 7½ lb.

The "Durex" Wiring System.

Another addition to the many wiring systems now in use has been made by Simplex Conduits, Ltd., Garrison Lane, Birmingham. "The Durex" system, as it is called, possesses the advantage of being applicable to either metal-sheathed or cab-tire-sheathed cables, both of which types are made by the company for use with the system. Both kinds of cable are made in twin and three-core flat styles and a wide range of sizes is available. The main part of a wiring system, apart

Fig. 2.—"Durex" Connector Box.

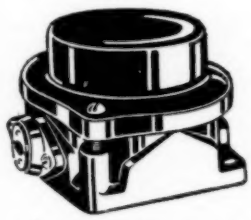


Fig. 3.—"Durex" Watertight Junction Box.

from the cables, is the connector box. In the "Durex" system this is a substantial cast metal box of circular shape (fig. 2) (2⅞ in. in diameter and 1¼ in. high), with glands consisting of a lead cone grip held in position by a gun-metal cap secured to the box by two small round-headed brass screws. The cover is secured by two screws. In the centre of the bottom of the box is a single countersunk hole for the fixing screw. The porcelain connectors are made with one, two, or three "ways," or a single piece may be obtained consisting of a circular base with a raised shield in the form of a cross for use in watertight boxes. The ceiling roses, tumbler switches wall plugs, &c., are all contained in covers similar in size and shape to the connector box, but there are also other designs available. The watertight junction box (fig. 3) is in a separate class, special glands and cover being provided. The system also includes ironclad fuses (d.p. and s.p.) and distribution boards. The fittings are stove-enamelled in a French grey colour.

A Glass-wiping Machine.

The cleaning of drinking glasses in hotels, restaurants, and similar establishments is generally a lengthy process owing to the unsatisfactory nature of the methods employed. A machine has been designed by Mr. F. Ireland, of Chorlton-cum-Hardy, Manchester, to speed up glass cleaning. This machine, which is illustrated in figs. 4 and 5, embodies a small electric motor which drives a central spindle upon the end of which is mounted a circular wiping cloth or pad. Around this spindle are four others, each bearing a similar wiping pad,

Fig. 4.—A Glass-wiping Machine.

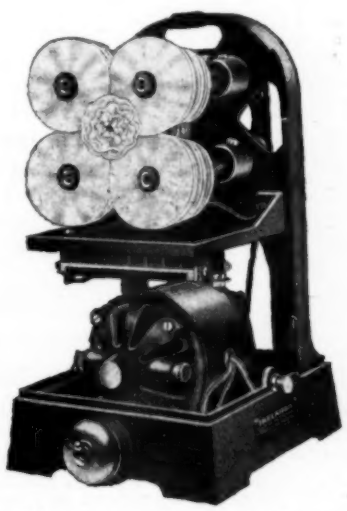


Fig. 5.—A Glass-wiping Machine.

driven by the central spindle. The glass is placed on the end of the central spindle and the four surrounding wiping pads rest on the exterior of the glass; they rotate at a moderate speed and quickly accomplish the cleaning. To keep the wipers dry a small electric heater is mounted beneath them.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C.1.

2,547. "Method of increasing electric conductivity of alloys." Metallbank und Metallurgische Akt. Ges. January 27th. (Germany, January 27th, 1922.)
2,566. "Variable electrostatic condensers, &c." W. Dubilier. January 27th.
2,571. "Electric transmission of signals." J. Bethenod. January 27th. (France, October 4th, 1922.)
2,582. "Sparking plugs." T. K. Turpin. January 29th.
2,592. "Manufacture of electric incandescent lamps." H. J. Osborn. January 29th.
2,600. "Wireless receivers." F. J. Young. January 29th.
2,605. "Electric furnace covers." W. C. Fox. January 29th.
2,606. "Trolley-head guide for electric railways, &c." J. H. Deas. January 29th.
2,609. "Electro-magnetically-operated brakes." H. T. Boothroyd. January 29th.
2,610. "Switches for intermittent electric signs, &c." A. B. Gregson. January 29th.
2,614. "High-frequency transformer for wireless telegraphy, &c." E. G. Craven. January 29th.
2,623. "Terminals for electric conductors." A. P. McGowran and M-L Magneto Syndicate, Ltd. January 29th.
2,631. "Electric amplifying apparatus." Metropolitan-Vickers Electrical Co., Ltd., and A. E. L. Scanes. January 29th.
2,645. "Electric storage batteries." Dagno, Ltd., and J. H. Noble. January 29th.
2,651. "Testing materials." H. Baron (Signal Ges.). January 29th.
2,652. "Telephone receivers." British Thomson-Houston Co., Ltd., and A. P. Young. January 29th.
2,657. "Telephone systems." Western Electric Co., Ltd. (G. Deakin). January 29th.
2,664. "Electric current distributing systems." E. W. Marchant. January 29th.
2,691. "Electric measuring instruments." J. W. Record. January 30th.
2,692. "Electric measuring instruments." J. W. Record. January 30th.
2,703. "Electric head lamps." J. J. E. Sloan. January 30th.
2,704. "Electric lamp globes." J. J. E. Sloan. January 30th.
2,727. "Electric lamp fittings." M. J. Archer. January 30th.
2,728. "Telephone receivers, transmitters, &c." H. W. Symons and F. E. Wilson. January 30th.
2,746. "Telephone receivers, &c." N. Lea, Radio Communication Co., Ltd., and J. Scott-Taggart. January 30th.
2,751. "Ignition devices for internal-combustion engines." A. H. I. Morgan. January 30th.
2,757. "Apparatus for evacuation of electric incandescent lamps, &c." General Electric Co., Ltd. January 30th. (Germany, February 1st, 1922.)
2,758. "Determining sound direction." Signal Ges. January 30th. (Germany, February 8th, 1922.)
2,759. "Receivers for sound waves in liquids." Signal Ges. January 30th. (Germany, February 1st, 1922.)
2,760. "Apparatus for determining volume of air, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). January 30th.
2,761. "Electric arc welding systems." British Thomson-Houston Co., Ltd. January 30th.
2,762. "Carrier-current signalling systems." Western Electric Co., Ltd. January 30th. (United States, February 4th, 1922.)
2,773. "Thermionic valves." E. W. B. Gill. January 30th.
2,774. "Thermionic generators." Ges. für Drahtlose Telegraphie. January 30th. (Germany, February 14th, 1922.)
2,783. "Means for pulling down trolley poles of vehicles." H. Wade (E. R. Gainsford & Brown). January 30th.
2,791. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gillings. January 30th.
2,792. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. January 30th. (United States, May 10th, 1922.)
2,803. "Toy electric railway switches." E. C. R. Marks (American Flyer Manufacturing Co.). January 30th.
2,805. "Electric lamps for mines, &c." M-L Magneto Syndicate, Ltd., and H. S. Potter. January 30th.
2,807. "Electric distant control systems." E. Granat. January 30th. (France, February 8th, 1922.)
2,809. "Sparking plugs." B. L. Richardson (C. George). January 30th.
2,822. "Electrical devices for internal-combustion engines." H. C. Chambers. January 31st.
2,827. "Ceiling rose for electric lighting." J. Pownall. January 31st.
2,828. "Electric switch." J. Pownall. January 31st.
2,836. "Telegraphically transmitting and reproducing writing, &c." P. M. MacIntyre. January 31st.
2,837. "Valve-holders for wireless telegraphy, &c." W. J. S. Clemmey, F. G. Pulford, and W. L. Turner. January 31st.
2,840. "Electric appliances liable to overheating." R. Jenkins. January 31st.
2,847. "Manufacture of accumulator plates." J. H. Taylor and W. E. Taylor. January 31st.
2,876. "Magnets for magnetos, &c." W. H. Glasier and C. A. Vanderwell & Co., Ltd. January 31st.
2,895. "Protective means for alternating-current distributing systems, &c." F. C. Knowles and G. F. Shotter. January 31st.
2,906. "Device for testing electric installations of motor-cars, &c." D. J. Owen. January 31st.
2,910. "Flywheel dynamo-electric machines for internal-combustion engines." R. L. Aspden. January 31st.
2,915. "Bi-polar electrode electrolysers." S. F. Barclay and Mather and Platt, Ltd. January 31st.
2,919. "Electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). January 31st.
2,920. "Automatic systems." British Thomson-Houston Co., Ltd. January 31st. (United States, April 15th, 1922.)
2,921. "Wireless receiving apparatus." J. H. H. Hawkins. January 31st.
2,922. "Illuminated advertising apparatus with changing pictures." L. Loewenstein and Olso-Licht Ges. Halbmayr & Co. January 31st. (Austria, August 16th, 1922.)
2,924. "Electric resistance material." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. January 31st.
2,925. "Detecting arrangements for high-frequency telephony, &c." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. January 31st.
2,928. "Aerials for wireless signalling." Continental Automatic Telephone and Electric Co., Ltd. (Telephon-Fabrik Akt. Ges. vorm. J. Berliner). January 31st.
2,936. "Thermionic valves, &c." W. H. Hitchcock and A. E. Katz. January 31st.
2,937. "Thermionic valves, &c." W. H. Hitchcock and A. E. Katz. January 31st.
2,961. "Illuminated signs." W. Purdy. February 1st.
2,965. "Electric couplings." H. F. Shanahan. February 1st.
2,968. "Train position indicators." I. H. Parsons. February 1st.
2,989. "High-frequency transformers and means for tuning same." I. H. Parsons and H. R. Waddington. February 1st
3,002. "Galvanic cells or batteries." W. H. Edridge. February 1st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

19,234. "Construction of thermionic valves." S. R. Mullard and Mullard Radio Valve Co., Ltd. July 16th, 1921. (191,767.)
21,478. "Electric starters for internal-combustion engines." A. H. Midgley. August 12th, 1921. (191,769.)
21,786. "Electric transmitters for use in automatic telegraphy." Creed and Co., Ltd., and F. G. Creed. August 16th, 1921. (191,772.)
21,859. "Electrical connections between conductors." J. Firth and S. Cohen. August 17th, 1921. (191,773.)
24,180. "Signalling systems." J. Scott-Taggart and Radio Communication Co., Ltd. September 12th, 1921. (191,777.)
24,340. "Electrically-operated automatic valve regulators." A. J. H. Hadden (Automatic Temperature Control Co.). September 13th, 1921. (191,778.)
24,529. "Tide power generating systems." C. Klug. September 15th, 1921. (191,780.)
24,607. "Generators, switches, batteries, and wiring systems of electric lighting sets for motor vehicles and the like." W. J. Nicholas and P. J. W. Roberts. September 16th, 1921. (191,782.)
24,884. "Distant control apparatus." C. H. J. Harding. September 20th, 1921. (191,783.)
24,893. "Electric signalling system." H. D. Wight, W. Park, and Sunderland Forge and Engineering Co., Ltd. September 20th, 1921. (191,784.)
25,055. "Electric switches." Union Bag and Paper Corporation. July 22nd, 1921). (183,414.)
25,744. "Electric bell pushes." J. H. Moss. March 17th, 1922. (191,778.)
26,965. "Brilliant advertisement of traffic sign." A. E. Johns and E. Gibbon. October 12th, 1921. (191,794.)
27,023. "Electrical driving of machines on the constant current series system." G. Austin, J. C. Macfarlane, and W. A. Macfarlane. October 12th, 1921. (191,795.)
27,208. "Mouthpieces or trumpets for telephonic transmitting and receiving apparatus." E. A. Graham. October 13th, 1921. (191,801.)
27,308. "Holders for incandescent electric lamps." A. H. Hunt. October 14th, 1921. (191,804.)
27,355. "Devices for suspending cables, wires, ropes, pipes, and the like." M. Elder and W. M. Elder. October 14th, 1921. (191,807.)
27,433. "Electric lamps for vehicles." R. R. Sprosen and S. Wiseman. October 15th, 1921. (191,810.)
27,478. "Lamps suitable for automobiles." C. Collins, Ltd., and O. W. Horobin. October 17th, 1921. (191,816).
27,575. "Electro-magnetic lock for railway-carriage doors and the like." A. Crankshaw and T. Markland. October 18th, 1921. (191,825.)
27,639. "Brakes of tramcars and the like vehicles." English Electric Co., Ltd., H. H. Andrews. October 18th, 1921. (191,826.)
27,683. "Manufacture of electrodes." S. R. Illingworth. October 18th, 1921. (191,827.)
27,822. "Electric sound-producing horns." T. S. Rogers. October 20th, 1921. (191,831.)
28,249. "Electrical transmissions for direction purposes." Evershed and Vignoles, Ltd., and J. C. Needham. October 25th, 1921. (191,849.)
28,261. "Commutators or distributors for ignition systems of internal-combustion engines." P. Brindle. June 8th, 1922. (191,850.)
28,315. "Protective devices for electric circuits." Siemens Bros. & Co., Ltd., and W. E. Goodwin. October 25th, 1921. (191,852.)
28,438. "Bond wires for providing electrical conductivity for the joints of a railway track." A. J. Q. Smith (Atlas Railway Signal Co.). October 26th, 1921. (191,861.)
28,672. "Electric lamps operating by electric discharge." H. Marryat and M. D. Scott. October 28th, 1921. (191,866.)
28,889. "Radio signalling systems." National Pneumatic Co. July 16th, 1921. (183,416.)
28,894. "Electric power transmission systems for vehicles." J. B. Entz. November 5th, 1920. (171,090.)
29,142. "Telephone systems." J. E. Pollak (Siemens & Halske Akt. Ges.). November 2nd, 1921. (191,878.)
29,389. "Adjustable electrical resistance devices." E. A. Graham. November 4th, 1921. (191,879.)
29,426. "House-service cut-out, combined with sealing chamber." Macintosh Cable Co., Ltd., and D. D. Watson. November 4th, 1921. (191,880.)
30,059. "Ignition magnetos." R. Bosch Akt. Ges. May 14th, 1921. (180,290.)
30,353. "Electrical heating and cooking apparatus." W. W. Nobbs. November 14th, 1921. (191,890.)
30,692. "Pedal-actuated electric motor-control switches." W. Gee. March 20th, 1922. (191,893.)
30,968. "Electric heaters." British Thomson-Houston Co., Ltd. (General Electric Co.). November 19th, 1921. (191,897.)
32,140. "Welding by the electric arc." Premier Electric Welding Co., Ltd., and Dr. J. H. Paterson. November 30th, 1921. (191,910.)
33,473. "Electro-magnetic wave receiving and amplifying systems." F. J. Chambers. December 13th, 1921. (191,929.)
33,819. "Electric heater for bed-warmers, clothing, bandages, carpets, and the like." W. Schaufelberger. December 20th, 1920. (172,973.)
33,940. "Manufacture of grid resistances." L. Satchwell. December 16th, 1921. (Addition to 155,689.)) (191,934.)
34,959. "Control switches for electrically-propelled vehicles." P. V. Powell and P. Frost-Smith. December 29th, 1921. (191,943.)

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44. "Electrical bell or the like indicators." M. J. Railing, C. W. Saunders, and J. H. Collings. January 3rd, 1922. (191,947.)
418. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. March 16th, 1921. (177,140.)
1,784. "Mounting of the commutators of electric machines." Siemens-Schuckertwerke Ges. January 30th, 1921. (174,361.)
2,357. "Methods of introducing anodes for metal-vapour rectifiers." H. Weiss. February 1st, 1921. (174,925.)
2,782. "High-tension insulators of the bushing type." Allgemeine Elektricitats Ges. January 31st, 1921. (174,648.)
2,930. "Electric heating and cooking apparatus." W. B. Topp. February 5th, 1921. (174,937.)
3,400. "Protective means for electrical switchgear." A. H. Higgs and Ferranti, Ltd. February 6th, 1922. (191,971.)
3,736. "Alternating-current generators." Siemens & Halske Akt. Ges. February 8th, 1921. (175,279.)
4,282. "Electric inductance coils." B. H. N. H. Hamilton. February 14th, 1922. (191,973.)
6,608. "Apparatus for the electrical ringing of bells." Dr. H. Marlière. March 7th, 1921. (176,388.)
11,552. "Spark plugs." C. Hough. April 25th, 1922. (192,000.)
12,537. "Apparatus for mounting thermionic valves." P. Brunet and G. Pelletier. May 3rd, 1922. (192,007.)
15,596. "Telephone systems." Siemens & Halske Akt. Ges. June 21st, 1921. (128,103.)
16,797. "Overhead points or switches for electric trolley conductors for the collection of current for traction or any other purposes." L. Vallino. June 18th, 1921. (181,730.)
20,252. "Spark plugs." Dr. A. De Clairmont. July 24th, 1922. (192,024.)
28,083. "Telegraph recorder relay." W. P. D. van der Knaap. December 16th, 1921. (190,450.)